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NUCLEAR SCIENCE ABSTRACTS

Volume 11 February 15, 1957 No. 3

GENERAL

ATOMIC POWER

1390

THE COMING NUCLEAR INDUSTRY. H. E. Anderson. Chem. Eng. 63, No. 12, 191-210(1956) Dec.

A summary of nuclear industry in the U. S. with emphasis on the activities of interest to chemical engineers and the chemical processing industries is presented. (T.R.H.)

1391

RESEARCH REACTORS—U. S. GOVERNMENT POLICIES. R. R. Edwards (U. S. Atomic Energy Commission, Washington, D. C.). Nucleonics 14, No. 11, 66-9(1956) Nov.

Policies and procedures applied by the AEC for the international cooperation program in the peaceful uses of atomic energy through bilateral agreements negotiated between the United States and foreign nations are discussed. (W.L.H.)

BIOLOGY AND MEDICINE

RADIATION EFFECTS

1392 AECU-3080

Children's Cancer Research Foundation, Boston and New England Deaconess Hospital. Cancer Research Inst., Boston.

CARCINOGENESIS BY RADIOACTIVE SUBSTANCES. Jacob Furth and John L. Tullis. [1955]. 60p. $10.80 (ph OTS); $3.90(mf OTS).

A review is presented of factors influencing carcinogenesis in man induced by naturally occurring and artificially produced radioactive substances, the lung cancer problem in miners, the development of bone tumors in luminous dial painters and in patients treated with radium-containing nostrums, and the development of cancers in patients who received thorotrast (ThO_2) as a diagnostic procedure several decades ago. Some of the experimental work which indicates the extensiveness, the limitations, and the problems and prospects associated with the use of radioisotopes as carcinogenic agents are also reviewed. The external use of radioisotopes and the immediate and long-term hazards of radioactivity due to fall-out from nuclear tests are also discussed. (C.H.)

1393 AECU-3267

Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.

RADIATION EFFECTS ON A PNEUMOCOCCAL INFECTION PRODUCED BY SUBCUTANEOUS INJECTIONS INTO WHITE MICE. William E. Clapper and Grace H. Meade. Oct. 1953. 44p. Contract AT(29-1)-1242, Report No. 1.

Whole body x irradiation of white mice with 350 r had no effect on the course of bacteremia induced by subcutaneous inoculation with pneumococci at the time of exposure. When the radiation dose was given either 3 or 6 days before inoculation the death rate was increased, and the time from bacteremia to death was reduced when the radiation dose was given 6 days before inoculation. (C.H.)

1394 AF-SAM-55-135

Texas. Univ., Austin. Radiobiological Lab.

URINARY COPROPORPHYRIN EXCRETION OF RATS FOLLOWING GAMMA IRRADIATION. Elwood H. LaBrosse and Joe E. Smith. June 8, 1955. 6p.

Daily urinary coproporphyrin excretion of 1-year-old female Sprague-Dawley rats was determined for four days pre-irradiation and four days post-irradiation. The rats were divided into five groups of 4 animals each and were exposed to gamma irradiation from a Co^{60} source at a dose rate of 100 r/min. Total doses were 100 r, 250 r, 500 r, 750 r, and 1,000 r. No relationship was observed between dose and post-irradiation coproporphyrin excretion. Urinary coproporphyrin excretion does not appear to offer promise as a biologic dosimeter. (auth)

1395 AF-SAM-56-85

School of Aviation Medicine, Randolph AFB, Texas.

EFFECTS OF HIGH INTENSITY X-IRRADIATION ON THE RETINA. A HISTOLOGICAL, HISTOCHEMICAL, AND CHEMICAL STUDY IN THE RABBIT. Sidney P. Kent and Arnold A. Swanson. Mar. 5, 1956. 10p.

The retinae of 90 rabbits were examined chemically and histochemically for succinic dehydrogenase and glycogen. They were also examined histologically. Forty-five of the animals received 6,000 r of x irradiation to the eyes. Forty-five were nonirradiated controls. Five irradiated and five nonirradiated control animals were sacrificed by decapitation 0.5, 1, 2, 4, 6, 12, 24, 48, and 72 hours after irradiation. Morphologic changes consisting largely of pyknosis in the outer nuclear layer and fragmentation of the visual cell layers were first noted 4 hours postirradiation. These changes were noted in all subsequent irradiated groups. The glycogen content, particularly of the visual cell layer, increased in the 4-hour irradiated group while the succinic dehydrogenase activity decreased. Both changes were noted in all subsequent irradiated groups. (auth)

1396 AEC-tr-2681

THE QUESTION AS TO WHETHER FOODSTUFFS AFFECTED BY IONISING RADIATIONS ARE DANGEROUS TO HEALTH. J. Kuprianoff. Translated by E. Wait from Deut. Lebensm.-Rundschau 1, 1-(?)(1956). 13p.

A review of the literature was made on the effects of irradiation on foodstuffs. Hazards from the accidental contamination of natural and stored foodstuffs by fission products due to fall-out from nuclear explosions are considered. Factors affecting the wholesomeness of foodstuffs preserved by exposure to irradiation are discussed. (C.H.)

1397

EFFECTS OF VARIOUS DIETARY FACTORS ON THE ABSORPTION PROCESSES OF SMALL INTESTINES IN ANIMALS EXPOSED TO DAMAGING IRRADIATION. V. A. Shaternikov. Med. Radio. 1, No. 4, 61-7(1956) July-Aug. (In Russian)

1398
LIVER CELL NUCLEI OF MICE AFTER IRRADIATION. Hella Sussman. Onocologia 9, No. 4, 373-86(1956). (In German)

1399
STRIPE RUST RESISTANT MUTANTS OBTAINED FROM IRRADIATION OF GABO WHEAT. C. F. Konzak, N. E. Borlaug, Aristeo Acosta, and John Gibler (Brookhaven National Lab., Upton, N. Y.). Phytopathology 46, 525-6(1956) Sept.

1400
ELECTRON MICROSCOPIC DETECTION OF COAGULATION IN P^{32}-LABELED ERYTHROCYTES. Bruno Lindemann. Strahlentherapie 101, 3-10(1956) Sept. (In German)

In the test tube experiment one can observe by means of the electron microscope on erythrocytes marked with P^{32} spontaneously hemolysing, decaying cells, and red blood-cells showing centres of coagulation which might correspond to intercellular hit regions. After 48 hours the coagulation centres begin to mark, they reach an extension of 1 μ after the fourth day. After 6 days they have seized the whole cell. In erythrocytes prepared from blood gathered by venipuncture of people who suffer from polycythemia and who have received therapeutical doses of P^{32}, the same coagulation centres appear in the red blood cells isolatedly. (auth)

1401
PRESERVATION OF POTATOES BY EXPOSURE TO X-RADIATION. Hans Otten and Christoph Pätzold. Strahlentherapie 101, 152-7(1956) Sept. (In German)

The report deals with experiments on sprout inhibition in potatoes by means of x rays. A dose of 7000 r has proved sufficient for medium size tubers. There is no risk of toxic irradiation products, as far as can be ascertained up to now. A certain influence on vitamins is unavoidable. Changes in taste cannot be proved. The use of x rays is not an economic proposition. This may become possible with the help of radio-active isotopes, which will soon be available to a greater extent. (auth)

RADIATION HAZARDS AND PROTECTION

1402 NYO-4441
Massachusetts Inst. of Tech., Cambridge. Sedgwick Labs. of Sanitary Science.
THE REMOVAL OF RADIOACTIVE FALL-OUT FROM WATER BY MUNICIPAL AND INDUSTRIAL WATER TREATMENT PLANTS. Robert A. Lauderdale and Rolf Eliassen. Mar. 1, 1956. 79p. Contract AT(30-1)-621. $0.50(OTS).

The results of a survey to determine the extent of removal of radioactive fall-out by municipal and industrial water treatment plants are presented. It was found that the removals obtained are subject to extreme variation but that over a period of time an average removal of from 50 per cent to 75% may be expected. The type of treatment used and the characteristics of the raw water source had little apparent affect on the efficiency of removal of the gross β contamination. (auth)

1403 USNRDL-TR-101
Naval Radiological Defense Lab., San Francisco.
THERMAL VULNERABILITY OF MILITARY INSTALLATIONS. A. Broido and C. Trilling. Aug. 11, 1955. 99p. Project NS-083-001. (AFSWP-911).

In the event of an atomic attack, fire damage as a result of thermal radiation may extend well beyond the region of serious blast effects. The probability of producing disastrous fires in a military installation is dependent to a large extent upon the condition of the base and its environs at the time of attack. Moreover, certain practices which, from a conventional fire prevention point of view, were considered acceptable or even desirable may serve to increase the probability of thermal damage. Following a survey of about 100 typical military installations, this study attempts a realistic evaluation of the characteristics of existing military installations which make these installations vulnerable to the thermal effects of atomic weapons. Factors influencing fire initiation, fire spread, and fire suppression are considered. Realistic changes in philosophy as well as in construction of present and future installations are discussed. (auth)

1404
SOME PROBLEMS ON THE RADIOLOGICAL PROTECTION: ESPECIALLY CONCERNING WITH THE MAXIMUM PERMISSIBLE DOSE. Gakuro Ito and Yasuyuki Moriuchi. Ôyô Butsuri 24, No. 1, 3-17(1955) Jan. (In Japanese).

Refer also to abstract 1593.

TOXICOLOGY STUDIES

1405 UR-477
Rochester, N. Y. Univ. Atomic Energy Project.
PATHOLOGIC EFFECTS OF ORALLY ADMINISTERED POLONIUM. George W. Casarett. Nov. 16, 1956. 29p. Contract W-7401-eng-49. $4.80(ph OTS); $2.70(mf OTS).

Rats receiving by gavage a single dose of polonium chloride (566 μc of Po per kg body weight) from which they absorbed about 26 μc/kg, a dose lethal in 3 months or less, showed lesions most of which were qualitatively similar to those observed in rats receiving about 26 μc/kg of Po intravenously and dying within similar time periods. By comparison, there was considerably less effect in testes, bone marrow, spleen, and other lymphatic tissues in the oralloy treated rats, which is compatible with the comparatively lower concentrations of Po in these tissues following oral administration. Hemorrhagic phenomena were also much less prominent in orally treated rats. The principal pathologic changes which contributed to the lethality of orally treated rats, but which were not found in a similar period of time in the intravenously injected rats, were the development of progressive nephrosclerosis and the production of considerable damage of the intestinal mucosa. The intestinal damage was such that it was undoubtedly caused partly by unabsorbed Po. Under these circumstances the lethality of orally administered Po cannot be related solely to absorbed Po. (auth)

TRACER APPLICATIONS

1406 UCRL-3503
California. Univ., Berkeley. Radiation Lab.
EXPERIMENTS WITH NORMAL AND DIABETIC RATS USING CARBON-14 RESPIRATION PATTERNS. Bert M. Tolbert and Martha R. Kirk. Sept. 6, 1956. 27p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

Normal and alloxan-diabetic rats with and without insulin, Carbutamide, or Orinase have been studied by use of C_6^{14}, respiration patterns. Substrates have included glucose-C^{14}, fructose-C_6^{14}, sodium acetate-2-C^{14}, and lactic-1-C^{14} acid. It has been shown that such patterns are a good index of diabetes, that the three drugs increase glucose oxidation in normal animals, that insulin can return the abnormal diabetic pattern to normal in all cases, and that Carbutamide and Orinase can do so only in certain cases. The data and time studies indicate that these last two drugs do not act by an anti-insulinase action, but seem to operate as insulin-production stimulators combined with some other action. (auth)

1407
THE RATE OF DEUTERIUM PENETRATION INTO PLANT TISSUE. V. M. Kutyurin (Institute of Geochemistry and Analytical Chemistry, Moscow). Biochemistry (U.S.S.R.) 21, 43-5(1956) Jan.-Feb. (In English)

1408
THE STRIPPING-FILM TECHNIQUE OF AUTORADIOGRAPHY. S. R. Pelc (Hammersmith Hospital, London). Intern. J. Appl. Radiation Isotopes 1, 172-7(1956) Nov.

1409
QUANTITATIVE AUTORADIOGRAPHY USING A RADIOACTIVE WEDGE. Ya. V. Mamul (Institute of Biophysics of the Academy of Sciences, U.S.S.R.). Intern. J. Appl. Radiation Isotopes 1, 178-83(1956) Nov.

1410
AUTORADIOGRAPHY BY NEUTRON ACTIVATION: THE CELLULAR DISTRIBUTION OF BORON-10 IN THE TRANSPLANTED MOUSE BRAIN TUMOUR. Leon Edwards (Massachusetts General Hospital, Boston). Intern. J. Appl. Radiation Isotopes 1, 184-90(1956) Nov.

1411
AUTORADIOGRAPHY OF SERIAL CROSS-SECTIONS OF UNDECALCIFIED BONE. J. H. Marshall, V. K. White, and J. Cohen (Massachusetts Inst. of Tech., Cambridge and Children's Medical Centre, Boston). Intern. J. Appl. Radiation Isotopes 1, 191-3(1956) Nov.

1412
INVARIANTS IN EXPERIMENTAL DATA ON LINEAR KINETICS AND THE FORMULATION OF MODELS. Mones Berman and Robert Schoenfeld (Sloan-Kettering Inst., New York and Polytechnic Inst. of Brooklyn). J. Appl. Phys. 27, 1361-70(1956) Nov.

A new mathematical approach for the analysis of radioactive tracer experiments on compartmentalized systems in steady states is presented. The experimental measurements of the amounts of tracer in one or more compartments are approximated by a sum of exponential functions of time. The coefficients and exponential factors of these functions are shown to represent a set of invariants of the data. These are then related in a concise matrix equation to the compartmental model parameters, which are defined as the transition probabilities per unit time per unit quantity (turn-over rates) of molecules from one compartment (or state) into another. When measurements are incomplete, the freedom in choosing a model is expressed in turns of a minimum number of variables equal to the difference between the number of model parameters and the number of invariants found in the data. It is shown how other information regarding the model parameters or the amounts of material in steady state may be combined with the tracer data to reduce the degrees of freedom of a proposed model. Matrix transformations are worked out to allow the mapping of all mathematically consistent models in the configuration space of the minimum variables. The boundaries in this space corresponding to the limits for physically realizable models are found. Thus, a model is expressed by a set of coordinates and the values of all the parameters are obtained by substituting the values of the coordinates. Investigation of the range of variation of each parameter over the bounded region is also possible. (auth)

CHEMISTRY

1413 WADC-TR-53-133(Pt.3)
Plax Corp., Hartford, Conn.
INVESTIGATION OF THE SHELF LIFE OF LIQUIDS IN POLYETHYLENE BOTTLES. PART 3. INVESTIGATION OF THE EFFECTS OF MOLECULAR WEIGHT, CHAIN BRANCHING, AND IRRADIATION ON POLYETHYLENE WITH REGARD TO SHELF LIFE IN BOTTLES. Period Covered: July 1954 to April 1955. Jules Pinsky, A. R. Nielsen, and J. H. Parliman. Sept. 1956. 84p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: PACKAGING MATERIALS. Contract AF33 (616)-112. (AD-97334).

From these studies it is concluded that the permeability of polyethylene bottles of various types decreases as density increases (fewer short-chain branches). The effects of radiation on the permeation of such materials as H_2SO_4, HCl, HNO_3, NaOH, NH_4OH, alcohols, esters, ethers, ketones, turpenes, aniline, aromatic and aliphatic hydrocarbons, and NaOCl were studied. (T.R.H.)

1414 WADC-TR-53-133(Pt.3, Suppl.1)
Connecticut. Univ., Storrs and Plax Corp., Hartford, Conn.
INVESTIGATION OF THE SHELF LIFE OF LIQUIDS IN POLYETHYLENE BOTTLES. PART 3, SUPPLEMENT 1. THEORETICAL INVESTIGATION OF THE EFFECTS OF MOLECULAR WEIGHT, SIDE CHAIN BRANCHING, AND IRRADIATION ON THE MECHANISM OF TRANSFER OF MATERIALS THROUGH POLYETHYLENE. Period covered: July 1954 to April 1955. Henry A. Bent and Jules Pinsky. Sept. 1956. 42p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: PACKAGING MATERIALS. Contract AF33(616)-112. (AD-97335).

It is found that chain branching and irradiation increase swelling coefficients and diffusion constants at low temperatures, but decrease them at very high temperatures. The importance of placing room temperature P-Factors in this perspective is stressed. It is suggested that activated diffusion through polyethylene induces structural changes in the polymer not unlike local melting. Thermodynamical reasoning also indicates that frequency and P-Factors increase with increasing rigidity and mass of penetrant. In both respects CCl_4 shows this increase with polyethylene. (auth)

1415 AD-95105
Michigan. Univ., Ann Arbor. Engineering Research Inst.
THE CHEMISTRY OF BORON HYDRIDES AND RELATED HYDRIDES. Quarterly Report No. 1 [for] January–March 1956. R. W. Parry, Goji Kodama, S. G. Shore, R. C. Taylor, and Earl Alton. May 1956. 26p. Project 2469. Contract AF33(616)-3343.

Evidence is presented to show that B_4H_{10} reacts with NH_3 to form $B_4H_{10} \cdot 7NH_3$, $B_4H_{10} \cdot 3NH_3$, and $B_4H_{10} \cdot 2NH_3$. The product formed is dependent upon experimental procedures. No evidence for $B_4H_{10} \cdot 4NH_3$ has been found. The addition product formed by B_4H_{10} in liquid ammonia at −77°C reacts with excess Na to give $\frac{1}{2}$ mole H_2 per B_4H_{10} and the solid NaB_3H_8. Results are interpreted in terms of bridge cleavage in B_4H_{10}. A Raman study of H_3BCO is described in detail. (auth)

1416 AEC-tr-2674
CHLORINE ELECTRODE OF COMPARISON IN MOLTEN CHLORIDES. M. V. Smirnov, S. F. Plaguev, and L. E. Ivanovskii. Translated by [S.] Botcharsky from Zhur. Fiz. Khim. 29, 772-7(1955). 6p.

The conditions influencing the stability and reproducibility of chlorine electrode potential of comparison in molten chlorides were investigated. It has been shown that carbon electrodes for spectral analysis are the most suitable for the production of chlorine electrodes of comparison. It was shown that in order to accelerate the attainment of the stationary value of the potential of a chlorine electrode the carbon electrode should be polarized anodically in molten

chlorides for a few minutes. The possibility of measuring the potentials in molten chlorides by means of a chlorine electrode with an accuracy of 10^{-5} V has been proved. (auth)

1417 AEC-tr-2690

A. C. MEASURING METHODS IN ELECTROCHEMISTRY. Heinz Gerischer. Translated by R. S. Forsyth from Z. Elektrochem. 58, 9-24(1954). 29p.

Methods of measuring conductance and dielectric polarization using sine-wave a-c as applied in electrochemistry are discussed. (T.R.H.)

1418 AEC-tr-2691

THE INFLUENCE OF RATE OF REACTION ON THE CURRENT DENSITY IN FOLLOWING THE COURSES OF REACTIONS BY THE DIFFUSION BOUNDARY CURRENT. D. Winkelmann. Translated by R. J. Richardson from Z. Elektrochem. 59, 895-7(1955). 7p.

The mathematical treatment given here facilitates the following of short half-life reactions by diffusion boundary current measurements. The relationship of reaction rate to current density is derived for homogeneous reactions, and also for the case of electrode surface catalysis. (T.R.H.)

1419 AEC-tr-2694

CALCULATION OF THERMODYNAMIC CONSTANTS OF UNSATURATED HALIDES FROM THE E. M. F.'S AND TEMPERATURE COEFFICIENTS OF CHEMICAL CELLS AND DANIEL-JACOBI CELLS. B. F. Markov. Translated from Zhur. Fiz. Khim. 30, 1537-9(1956). 7p.

Heats of formation of TlCl, $SnCl_2$, and CuCl were calculated and compared with those obtained from emf measurements. (T.R.H.)

1420 AEC-tr-2695

THE USE OF A POLAROGRAPH FOR THE AUTOMATIC RECORDING OF POLARIZATION CURVES IN FUSED SALTS. L. N. Antipin, Yu. (Iu.) B. Kholtanskikh, and S. F. Vashenin. Translated from Zhur. Fiz. Khim. 30, 1672-5(1956).

It is concluded that the commutator method is superior to the direct compensation method in the use of a polarograph for automatic recording of polarization curves in fused salts. (T.R.H.)

1421 TT-639

THE DECOMPOSITION OF ARYL DIAZONIUM FLUOBORATES AS A METHOD OF OBTAINING PURE BORON FLUORIDE. (O Razlozhenii Ftoroboratov Arildiazoniia kak Metode Polucheniia Chistogo Ftoristogo Bora). G. M. Panchenkov, V. M. Moiseev, and Yu. (Iu.) Lebedev. Translated by G. Belkov from Doklady Akad. Nauk S.S.S.R. 100, 1103-6(1955). 8p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-4720. (C.W.H.)

1422

STUDIES ON THE HYDROLYSIS OF METAL IONS. XVI. THE HYDROLYSIS OF THE BERYLLIUM ION, Be^{+2}. Hidetake Kakihana and Lars Gunnar Sillen (Royal Inst. of Tech., Stockholm, Sweden). Acta Chem. Scand. 10, No. 6, 985-1005(1956).

The hydrolysis of the ion Be^{+2} has been studied by electrometric titrations at constant ionic medium (3 M ClO_4^-), using quinhydrone and hydrogen electrodes. A mathematical analysis was made of the curves Z (log h)$_B$ giving Z, the average of OH bound per Be, as a function of log h, at various total beryllium concentrations B. It was concluded that the main product is $Be_3(OH)_3^{+3}$; for the equilibrium constant of the reaction $3Be^{+2} + 3H_2O \rightleftharpoons Be_3(OH)_3^{+3} + 3H^+$, $\log K_{33} = 8.66 \pm 0.03$ was obtained. No evidence was found of the complexes $(BeOH)_2^{+2}$ and $(BeOH)_4^{+4}$ proposed by previous workers. Deviations at low values of B and Z indicate the presence of Be_2OH^{+3} and $Be(OH)_2$. The vest value for the equilibrium constants were: $2Be^{+2} + H_2O \rightleftharpoons Be_2OH^{+3} + H^+$, $\log K_{12} = -3.24 \pm 0.02$; $Be^{+2} + 2H_2O \rightleftharpoons Be(OH)_2 + 2H^+$, $\log K_{21} = -10.9 \pm 0.2$. Slight deviations at $Z > 0.9$ where equilibrium is achieved very slowly may be due to precipitation or to higher complexes. (auth)

1423

THE HETEROGENEOUS EXCHANGE REACTION BETWEEN HYDROGEN CHLORIDE AND CHLORINE ON GLASS AND FLUOROCARBON. J. R. Walton and W. H. Johnston (Purdue Univ., Lafayette, Ind.). J. Am. Chem. Soc. 78, 5991-2(1956) Dec. 5.

The heterogeneous exchange reaction between HCl and Cl_2 was studied on Pyrex and Vycor glasses and on fluorocarbon using Cl^{36}. Evidence was obtained that this reaction proceeds through catalysis by absorbed water which was removed both by evacuations at elevated temperatures and by treatment with diborane at room temperature. By varying the amount of adsorbed water, half-times of exchange were obtained from one minute to six days. The rate law of the reaction producing exchange was determined on Vycor and found to be consistent with equilibria adsorptions and a rate-controlling surface reaction. The rate in moles liter^{-1} sec.$^{-1}$ was $5.0 \times 10^{-6}(HCl)^{0.37}(Cl_2)^{0.37}$ for concentrations in moles liter^{-1}. (auth)

1424

THE HYDROGEN–BROMINE REACTION AT ELEVATED TEMPERATURES. Myron N. Plooster and David Garvin (Princeton Univ., N. J.). J. Am. Chem. Soc. 78, 6003-8 (1956) Dec. 5.

The onset of explosions in mixtures of H_2 and Br_2 both with and without added inert gases has been studied in the temperature range 850 to 1140°K. A shock wave compression technique was used in order to heat the mixtures to the explosive range in times short compared to the "induction periods" preceding explosion. The phenomenon can be treated adequately as a thermal explosion. The reaction sequence established for the low temperature H_2–Br_2 reaction and suitably extrapolated values of the individual rate constants suffice for a quantitative explanation of the temperature dependence of the induction times. The usual assumption of "steady state" concentrations of Br and H atoms is not applicable here. (auth)

1425

THE SULPHATES AND SELENATE OF POLONIUM. K. W. Bagnall and J. H. Freeman (Atomic Energy Research Establishment, Harwell, Berks, England). J. Chem. Soc., 4579-82(1956) Nov.

A basic sulphate and selenate, $2PoO_2,SO_3$ and $2PoO_2,SeO_3$, and a disulphate, $Po(SO_4)_2$, have been prepared; the disulphate probably forms a series of hydrates. The solubilities of these compounds in sulphuric and selenic acid have been investigated. Unstable compounds analogous to the tellurium and selenium derivatives are formed from polonium metal and sulphur trioxide or selenium trioxide. (auth)

ANALYTICAL PROCEDURES

1426 ANL-5641

Argonne National Lab., Lemont, Ill.

THE X-RAY SPECTROMETRIC DETERMINATION OF URANIUM IN SOLUTION. D. S. Flikkema, R. P. Larsen, and R. V. Schablaske. Nov. 1956. 10p. Contract W-31-109-eng-38. $0.15(OTS).

An x-ray spectrometric method has been developed for the determination of milligram quantities of U in solution. In speed, sensitivity and accuracy it is comparable to spectrophotometric methods. Its freedom from interfer-

ences other than gross concentrations of other elements makes it notably superior for many applications. (auth)

1427 DOW-150

Dow Chemical Co. Western Div., Pittsburg, Calif.
RAPID SPECTROPHOTOMETRIC DETERMINATION OF SUBMILLIGRAM QUANTITIES OF URANIUM. Carl A. Francois. Nov. 1, 1956. 36p. Contract AT-30-1-GEN-236. $6.30(ph OTS); $3.00(mf OTS).

A simple colorimetric method for U involving solvent extraction of UO_2^{2+} from $Al(NO_3)_3$ solution with TBP in iso-octane is described. An aliquot of the TBP–iso-octane–uranium mixture is introduced into an acetone–water solution of dibenzoyl-methane, and the resulting complex is measured spectrophotometrically at 410 mμ. There is no interference from common cations except Th and precision is good. (T.R.H.)

1428 IDO-14387

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
DETERMINATION OF FREE ACID IN THE PRESENCE OF HYDROLYZABLE IONS. Glenn L. Booman, Maxine C. Elliott, Robert B. Kimball, Fred O. Cartan, and James E. Rein. Sept. 28, 1956. 15p. Contract AT(10-1)-205. $0.20(OTS).

A simple method for the routine determination of free acid in hydrolyzable ion solutions is presented using $K_2C_2O_4$ as a complexing agent. Conditions for minimum bias are obtained from pH-bias curves. To obtain bias values 1.5M metal ion solutions were titrated to a sharply defined conductance endpoint. (auth)

1429 NBL-133

New Brunswick Lab., AEC, N. J.
SEMIANNUAL PROGRESS REPORT FOR THE PERIOD JANUARY 1956 THROUGH JUNE 1956. C. J. Rodden. Oct. 1956. 29p. $0.25(OTS).

A new method for the determination of BeO in Be metal has been developed. Spectrophotometric procedures for the determination of Si in UF_4 and MgF_2 were developed. Reactivity tests were made on a UO_3 standard. A review of the current work on the continuous polarographic determination of U in process streams is given. Further studies were made on the development of Ra analysis by γ-ray measurements with a high pressure ionization chamber. (For preceding period see NBL-127.) (W.L.H.)

1430 ORNL-2161

Oak Ridge National Lab., Tenn.
THE USE OF TRIALKYL PHOSPHINE OXIDES AS EXTRACTANTS IN THE FLUOROMETRIC DETERMINATION OF URANIUM. J. C. White. Nov. 1, 1956. 30p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Tri-n-octyl and tri-n-decylphosphine oxides were shown to be excellent extractants for U in its fluorimetric determination. These phosphine oxides quantitatively extract U from solutions that are as concentrated as 12M with respect to such acids as H_2SO_4, H_3PO_4, and HCl acids. The extraction is also quantitative in the presence of such anions as citrate, oxalate, and tartrate that form strong complexes with the UO_2^{2+} in solution. A simple extraction procedure was developed which is applicable under essentially all conditions. In this procedure, 5 ml of 6M HNO_3 is added to a 1-ml aliquot of the sample which is then shaken for 5 minutes with 5 ml of 0.1M phosphine oxide in versol. Although the reagents are not commercially available, their synthesis is not particularly difficult. A detailed procedure is presented for the preparation of tri-n-octylphosphine oxide. (auth)

1431 UCLA-382

California. Univ., Los Angeles. Atomic Energy Project.
THE TRANSPORT OF FATTY ACID AS MONO- AND DIGLYCERIDE. Dorothy L. Fillerup and James F. Mead. Nov. 30, 1956. 16p. Contract AT-04-1-GEN-12. $3.30(ph OTS); $2.40(mf OTS).

1432 WADC-TR-54-616(Pt. II)

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
HYDROGEN CONTAMINATION IN TITANIUM AND TITANIUM ALLOYS. PART II. COMPARISON OF VARIOUS METHODS FOR HYDROGEN ANALYSIS. [Period covered] January 1955 to May 1956. John W. Seeger and Jack A. Winstead. Oct. 1956. 90p. Project titles: METALLIC MATERIALS, and MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task titles: TITANIUM METALS AND ALLOYS. and PROCEDURES FOR THE COMPOSITION ANALYSIS OF AIRCRAFT MATERIALS. (AD-110412).

Descriptions of various analytical methods for H determination in Ti and its alloys are presented, with information on operating procedures and costs. Laboratories using these methods in general are in disagreement, and vary considerably in analytical reproducibility. Material nonuniformity in H distribution from position-to-position in a sheet examined in relation to experimental error is found to be a significant factor. A suggested experiment for a single sheet disputed between two laboratories is given as a model by which appropriate experiments can be devised to incorporate the sources for disagreement found in this investigation. (auth)

1433 AEC-tr-2664

THE BIOELEMENT URANIUM IN THE PLANT AND ANIMAL KINGDOM AS WELL AS IN THE HUMAN ORGANISM. Joseph Hoffman. Translated from Biochem. Z. 313, 377-87(1942). 21p.

A method is described for the determination of trace amounts of uranium in biological materials. Results are included from the analysis of a number of samples of both plant and animal origin. (C.H.)

1434 AEC-tr-2665

ON THE OCCURRENCE OF TRACE ELEMENTS, ESPECIALLY URANIUM, IN THE BEEF LIVER AND SPLEEN. Joseph Hoffman. Translated from Hoppe-Seyler's Z. physiol. Chem. 273, 115-17(1942). 6p.

The occurrence of trace amounts of uranium in beef liver, spleen, and bone is reported. (C.H.)

1435 AEC-tr-2672

POLAROGRAPHIC INVESTIGATION OF MOLTEN SALTS BASED ON POTASSIUM CHLORIDE. I. D. Panchenko. Translated by [S]. Botcharsky from Ukrain. Khim. Zhur. 21, 468-71(1955). 4p.

The potentials for the deposition of Ag, Pb and Ca on a Pt electrode on molten KCl base have been determined. In a polarographic investigation of molten salts on a base of KCl a direct proportional dependency between the value of the diffusion limit current and the concentration of the investigated salt is maintained. Polarographic curves taken on solid Pt electrodes in molten salts are described by the Geirovskii-Ilkovich equation $E_{d.e.} = E_{½} - (RT/nF) \ln (i/i_d - i)$, moreover the experimental value of the factor before the logarithm is practically the same as the theoretical one. (auth)

1436 AEC-tr-2686

SELECTIVITY AND SPECIFICITY OF ORGANIC REAGENTS. G. J. Henning. Translated by F. E. Cox from Chem. Weekblad 51, 519-27(1955). 18p.

A short literature review is given about the connection between the analytic characteristics of an organic reagent and the stability of the formed metal ion reagent complexes. Some factors that can influence this stability will be discussed, as well as the behaviour of some specific reagents.

Lastly the possibility of "forecasting" the characteristics of new reagents is reviewed. (auth)

1437 AEC-tr-2698

ON THE ACTIVITY OF BETA-RADIATION FROM THE BLOOD OF MAN. A. I. Danilenko. Translated by S. Batcharsky from Doklady Akad. Nauk S.S.S.R. 107, 683-4(1956). 4p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 10-9109. (C.H.)

1438

INSTRUMENTAL METHODS OF GAMMA-RAY SPECTROMETRY. R. E. Connally (Hanford Atomic Products Operation, Richland, Wash.). Anal. Chem. 28, 1847-53 (1956) Dec.

The gamma-ray spectrometer and its application to the rapid analysis of mixtures of γ-emitting radioisotopes are discussed. The parameters of importance in the selection of the γ-sensing unit are shown. The pulse height analysis systems commercially available for use in γ-ray spectrometry are evaluated regarding their use as both qualitative and quantitative analytical instruments. The precision to be expected with each type of system is also discussed. (auth)

1439

COULOMETRY WITH QUINQUEVALENT URANIUM. DETERMINATION OF FERRIC ION. Kenneth W. Edwards and David M. Kern (Dartmouth Coll., Hanover, N. H.). Anal. Chem. 28, 1876-8(1956) Dec.

Quinquevalent uranium, the primary reduction product of UO_2^{2+} in acid solutions, is a rapid and relatively powerful reducing agent, well suited for use in constant-current coulometry. Determinations of Fe in amounts from 25 to 0.025 mg were accurate within ±0.2%. The disproportionation of U^{5+} does not interfere above pH 1.5. (auth)

1440

DETERMINATION OF CHLORIDE IN TITANIUM SPONGE BY THE RAPID POTENTIOMETRIC METHOD. H. V. Malmstadt, E. R. Fett, and J. D. Winefordner (Univ. of Illinois, Urbana). Anal. Chem. 28, 1878-82(1956) Dec.

Two procedures are presented for the rapid, precise, and accurate determination of 0.001 to 0.5% chloride in Ti sponge, requiring only about 7 minutes per determination after dissolution of the sample. The chloride analysis involves a final measurement of the voltage difference between two Ag-AgCl electrodes in a concentration cell, one arm of which contains the unknown chloride solution and the other a standard chloride solution. Prior to the potentiometric measurement the unknown chloride solution must be prepared to prevent interferences from substances in the Ti samples. In one procedure the chloride is removed from an aliquot of a H_2SO_4 solution of the Ti sample by a rapid distillation. In the other, the Ti sponge is dissolved in a measured quantity of either H_2SO_4 or fluoboric–sulfuric acid mixture and prepared for the potentiometric measurement by selective oxidation with hydroxylamine sulfate. (auth)

1441

DETERMINATION OF TITANIUM IN TITANIUM ORES AND METAL BY AUTOMATIC DERIVATIVE SPECTROPHOTOMETRIC TITRATION. Howard V. Malmstadt and Charles B. Roberts (Univ. of Illinois, Urbana). Anal. Chem. 28, 1884-6(1956) Dec.

To provide a relatively rapid and accurate method for determination of Ti in Ti ores, metal, and TiO_2, a procedure was developed utilizing the automatic derivative spectrophotometric end point detection system and electrolytic generation of the titrant at constant current. This provides a completely automatic titration method, which saves technician's time. After dissolution of the sample an aliquot of the solution is passed through a Cd reductor and collected in a solution containing a known quantity of Fe^{3+}. The Ti^{3+} reduces an equivalent amount of Fe^{3+} and the excess Fe^{3+} is automatically titrated with electrolytically generated Ti^{3+}. The total elapsed time for the determination of Ti in rutile or ilmenite is about 40 minutes, including fluxing and dissolution of the sample. The precision and accuracy are within about 0.1%. (auth)

1442

PHOTOMETRIC TITRATION OF CERIUM(III). Thomas L. Marple, E. P. Przybylowicz, and David N. Hume (Massachusetts Inst. of Tech., Cambridge). Anal. Chem. 28, 1892-4(1956) Dec.

A rapid and accurate method for the direct photometric titration of submilligram to decigram amounts of Ce^{3+}, even in the presence of large amounts of Ce^{4+}, has been developed. The method is based on the oxidation of the Ce to the quadrivalent state with permanganate in a neutral pyrophosphate medium. Reducing agents such as Hg^{2+}, V^{4+}, Ag^{3+}, Sb^{3+}, Tl^{+} and iodide interfere, as do substances such as Cr^{3+} and fluoride, which form precipitates. (auth)

1443

DIFFERENTIAL SPECTROPHOTOMETRIC DETERMINATION OF NEODYMIUM IN NEODYMIUM–YTTRIUM MIXTURES. Charles V. Banks, John L. Spooner, and Jerome W. O'Laughlin (Iowa State Coll., Ames). Anal. Chem. 28, 1894-7(1956) Dec.

A differential spectrophotometric method for the determination of macro amounts of Nd in Nd–Y mixtures permits determination of Nd in the presence of Yt with errors in concentration of only 2 to 3 parts per thousand. A theoretical treatment is given of the corrections made necessary by differences in the lengths and absorbances of the cells. (auth)

1444

AMPEROMETRIC TITRATION OF THE TETRAPHENYLBORATE ION. METHOD FOR POTASSIUM. Arthur F. Findeis and Thomas De Vries (Purdue Univ., West Lafayette, Ind.). Anal. Chem. 28, 1899-1901(1956) Dec.

Potassium tetraphenylborate dissolved in acetonitrile-water mixtures can be titrated with an aqueous solution of $AgNO_3$ with a high degree of precision. The method utilizes a dropping Hg electrode as an indicator with a mercury pool as a nonpolarized reference electrode at a potential of −0.1 volt vs. the pool. The procedure is suitable for between 1 and 20 mg. of K but could easily be extended to higher amounts. The precision and accuracy compare with other methods for K in this concentration range. (auth)

1445

DETERMINATION OF THORIUM IN URINE. R. W. Perkins and D. R. Kalkwarf (General Electric Co., Richland, Wash.). Anal. Chem. 28, 1989-93(1956) Dec.

A bioassay procedure can be used to determine Th in submicrogram amounts in urine. Thorium is separated from interfering materials by coprecipitation with LaF_3, followed by an extraction using 2-thenoyltrifluoroacetone in C_6H_6. The amount of Th is determined colorimetrically as the Th-morin complex. (auth)

1446

DETERMINATION OF ZIRCONIUM AND/OR HAFNIUM USING 1-NAPHTHYLGLYCOLIC ACID. R. B. Hahn and P. T. Joseph (Wayne Univ., Detroit). Anal. Chem. 28, 2019-21(1956) Dec.

Both Zr and Hf are precipitated quantitatively from dilute acid solution by 1-naphthylglycolic acid. No interference is caused by Al, Fe^{3+}, La, Sn^{4+}, Th, Ti, and UO_2^{2+}. The method was tested by the analysis of a zircon ore. The results obtained using 1-naphthylglycolic acid compare favorably with those obtained with mandelic acid. (auth)

1447

THE DETERMINATION OF MOLYBDENUM IN ITS BINARY ALLOYS WITH URANIUM BY HIGH-PRECISION SPECTROPHOTOMETRY. A. Bacon and G. W. C. Milner (Atomic Energy Research Establishment, Harwell, Berks, England). Anal. Chim. Acta 15, 573-9(1956) Dec.

High-precision spectrophotometry has been applied to the determination of Mo by using the coloured complex formed by this element with H_2O_2. This determination is best carried out from solutions about 1.5M in H_2SO_4 and 0.18M in H_2O_2. When absorbancy measurements are taken in the limited wavelength region of 360 to 380 mμ, the small interfering absorbancy from uranyl ions can be corrected for. A procedure has been developed for the determination of Mo in binary alloys containing U as the major constituent. This method is direct and rapid compared with gravimetric methods which require the preliminary separation of the Mo. For alloys containing more than 2.5% Mo a precision better than ±1.0% can be attained. Below this level, U interference renders the method less precise. (auth)

1448

A METHOD FOR THE DETERMINATION OF THE O^{18} CONCENTRATION OF THE OXYGEN OF ORGANIC COMPOUNDS. D. Rittenberg and Laura Ponticorvo (Columbia Univ. Coll. of Physicians and Surgeons, New York). Intern. J. Appl. Radiation Isotopes 1, 208-14(1956) Nov.

Oxygen-containing organic compounds can be oxidized to yield CO_2 by $HgCl_2$ (or Cu_2Cl_2 or Cl_2) at 360-530°C. The carbon dioxide formed in this reaction has the same O^{18} concentration as the original compound. This procedure has been tested and found to give the correct result on glucose, arginine, phenylalanine, tyrosine, benzamide, N-dinitrophenyl phenylalanine, and glycine. (auth)

1449

A SIMPLE METHOD FOR THE ASSAY OF TRITIUM IN WATER SAMPLES. J. E. S. Bradley and D. J. Bush (Postgraduate Medical School of London). Intern. J. Appl. Radiation Isotopes 1, 233-4(1956) Nov.

1450

RHODANINE-N-SALICYLIC ACID AND ITS USE IN THE ESTIMATION OF THORIUM. M. K. Rout (Ravenshaw Coll., Cuttack, India). J. Indian Chem. Soc. 33, 683-4(1956) Sept.

Rhodanine-N-salicylic acid has been used for the estimation of Th. On the basis of the weight of the complex obtained, a probable structure has been proposed for the Th complex. Additional support in favor of the proposed structure has been provided by ignition of a definite weight of the complex to ThO_2. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1451

CRYSTALLOGRAPHIC DATA: THORIUM TETRANITRATE PENTAHYDRATE, $Th(NO_3)_4.5H_2O$. Eugene Staritzky (Los Alamos Scientific Lab., New Mex.). Anal. Chem. 28, 2021 (1956) Dec. PLUTONIUM TETRANITRATE PENTAHYDRATE, $Pu(NO_3)_4.5H_2O$. Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 2021-2(1956) Dec. CERIUM TETRANITRATE PENTAHYDRATE, $Ce(NO_3)_4.5H_2O$. Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 2022-3(1956) Dec. YTTRIUM SESQUIOXIDE, Y_2O_3; DYSPROSIUM SESQUIOXIDE, Dy_2O_3; ERBIUM SESQUIOXIDE, Er_2O_3; and YTTERBIUM SESQUIOXIDE, Yb_2O_3. Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 2023-4(1956) Dec.

1452

STUDY OF THE WURTZITE-TYPE BINARY COMPOUNDS. I. STRUCTURES OF ALUMINUM NITRIDE AND BERYLLIUM OXIDE. G. A. Jeffrey, G. S. Parry, and R. L. Mozzi (Univ. of Pittsburgh). J. Chem. Phys. 25, 1024-31(1956) Nov.

The c/a ratios of the hexagonal AlN and BeO structures show that they do not have a regularly tetrahedral distribution of bonds. The structural details have been studied by x-ray analysis and are discussed in relation to the concepts of the electronegativity and electroneutrality of atoms. This gives a basis for an understanding of the distribution of the wurtzite and zinc blende lattices in the binary compounds of the group III/V and II/VI elements. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

1453

HYDROLYSIS OF ETHYLENE OXIDE DERIVATIVES IN DEUTERIUM OXIDE–WATER MIXTURES. J. G. Pritchard and F. A. Long (Cornell Univ., Ithaca, N. Y.). J. Am. Chem. Soc. 78, 6008-13(1956) Dec. 5.

The hydrolysis of several simple epoxides by the acid-catalyzed, the base-catalyzed and the uncatalyzed hydrolysis paths has been studied in deuterium oxide–water mixtures as solvent. For the acid-catalyzed reaction k_{D_2O}/k_{H_2O} varies from 1.9 to 2.2 and data for intermediate mole fractions of deuterium fit the Nelson and Butler theory quite well. It is concluded that this reaction involves a preliminary equilibrium proton transfer. For the base-catalyzed reaction the effect of deuterium oxide as solvent is small, k_{D_2O}/k_{H_2O} varying from ca. 1.0 to 1.1. This is consistent with the accepted Sn_2 mechanism. For the uncatalyzed hydrolysis the values of k_{D_2O}/k_{H_2O} vary from 0.8 to 0.9. This result serves to eliminate a mechanism which involves reaction of the conjugate acid form of the epoxide with hydroxide ion. However, it does not appear to permit a distinction between possible Sn_1 and Sn_2 reactions of epoxide with solvent. (auth)

1454

DENSITY OF LIQUID DEUTERIUM BROMIDE. M. Goldblatt and E. S. Robinson (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 60, 1588-9(1956) Nov.

The density of liquid DBr at one atm DBr gas from 0 to 25° can be determined from the equation $D = 1.961 - 5.981 \times 10^{-3} t + 3.503 \times 10^{-6} t^2$, where t = degrees centigrade. (T.R.H.)

Refer also to abstracts 1487 and 1568.

FLUORINE AND FLUORINE COMPOUNDS

1455 AEC-tr-2685

FLUORINATED POLYMERS. PART I. PHYSICAL PROPERTIES AND STRUCTURE. PART II. METHODS OF FABRICATION AND APPLICATIONS. Marcello de Malde. Pt. I translated by S. Pease and Pt. II by Ballinger from Materie plastiche 16, 164-70; 215-19(1950). 26p.

A new class of fluorinated polymers is discussed from the point of view of their physical properties and structure. (W.L.H.)

GRAPHITE

1456

THE MICROPORE STRUCTURE OF ARTIFICIAL GRAPHITE. C. N. Spalaris (General Electric Co., Richland, Wash.). J. Phys. Chem. 60, 1480-3(1956) Nov.

The surface characteristics of artificial graphite were investigated by means of nitrogen adsorption–desorption isotherms. Changes in surface area, pore size distribution and density of graphite were studied as a function of oxida-

tion. It was concluded that the binding materials used in the manufacture of graphite are largely responsible for the majority of the pores present. The variation in the pore size distribution with increasing oxidation must play an important role in the rate and/or mechanism of graphite oxidation. (auth)

1457

LATTICE VIBRATIONS AND SPECIFIC HEAT OF GRAPHITE. G. R. Baldock (Univ. of Liverpool, England). Phil. Mag. (8) 1, 789-802(1956) Sept.

The vibrations of the graphite lattice can be treated approximately by ignoring the interaction between displacements parallel and perpendicular to the layer planes. The normal modes then separate into two types, which may be called planar and transverse. The complete frequency distribution of the transverse modes is calculated and, with the aid of an approximate calculation of the distribution of the planar modes, the specific heat is deduced and compared with experimental results from 1.5° to 1000°K. Above 200° the atomic model gives results close to those obtained by superimposing two Debye two-dimensional continuum models but below 100° the interaction between layers becomes important. Below 20°, the transverse modes are dominant, and the result is very sensitive to the coefficient of interaction between second neighbours in the layer. This coefficient is close to a critical value which it would attain if the transverse restoring forces on the atoms of a single layer could be considered as acting only against out-of-plane bending of the bonds. It is shown that for any two-dimensional crystal the spectrum of the transverse vibrations is anomalous at low frequencies whenever the potential energy function satisfies certain conditions, and that these conditions are satisfied if the function is independent of any uniform small rotation of the crystal. (auth)

LABORATORIES AND EQUIPMENT

1458 IDO-14388

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

A STATISTICALLY DESIGNED TRAINING AND TESTING PROGRAM FOR AN ANALYTICAL CONTROL LABORATORY. G. A. Huff and F. H. Tingey. Oct. 2, 1956. 13p. Contract AT(10-1)-205. $0.20(OTS).

1459

APPARATUS FOR PREPARING METAL POWDERS UNDER PROTECTIVE ATMOSPHERES. H. L. Nurnberg, R. F. Domagala, and D. W. Levinson (Armour Research Foundation, Chicago). Rev. Sci. Instr. 27, 728-9(1956) Sept.

An apparatus originally conceived for directly preparing capillaries of powders of reactive alloys for x-ray study inspired the present device. The unit is simply a hermetically sealed chamber which is provided with a drive mechanism at the top, specimen and sight ports at the sides, and a funnel at the bottom. The drive mechanism is used to rapidly rotate a rotary cutter. Particles of any desired size are produced by a suitable choice of cutter and screen. The unit is extremely effective in its original role but has been used to prepare small quantities of powders of reactive alloys for other purposes, and is a versatile research tool. (auth)

MOLECULAR STRUCTURE

1460

AN INFRARED STUDY OF HALOFORM-BASE ASSOCIATION. AN ORDER OF ACIDITY OF HALOFORMS. Richard E. Glick (Brookhaven National Lab., Upton, N. Y.). Chemistry and Industry, 413-14(1956).

The infrared spectra of haloforms in $C_2Cl_4-(C_2H_5)_3N$ mixture were compared to those in C_2Cl_4 alone. It is concluded that the haloform-base association follows the order predicted if anionoid hyperconjugation contributes significantly to the H-bonded species (i.e.,I; Br>Cl>F). (T.R.H.)

1461

OPTIMUM ATOMIC SHAPE FOR BERTAUT SERIES. Robert E. Jones and David H. Templeton (Univ. of California, Berkeley). J. Chem. Phys. 25, 1062-3(1956) Nov.

Calculations are made of the error in the Madelung constant when computed by Bertaut's method with a finite number of terms and with various shapes for the charge distribution within the atoms. A charge density which is proportional to the distance from the edge of the spherical atom gives most rapid convergence for the range of accuracy one percent to 0.003 percent. For higher accuracy a better shape is charge density proportional to the square of the distance from the edge. If Gaussian atoms are used and overlap neglected, no choice of parameter allows an accuracy for a given number of terms as great as for the above functions. If the overlap effect is included by a second series (double series of Ewald), the convergence can be made more rapid than for any of the single series methods, but at the price of a more complicated program. (auth)

RADIATION CHEMISTRY

1462 NYO-685(Pts. I and II)

Patterson, Moos and Co., Inc., Long Island City, N. Y.

STUDY OF THE FEASIBILITY OF THE UTILIZATION BY CHEMICAL MEANS OF THE RADIANT ENERGY CONTAINED IN FISSION PRODUCTS. PART I. STUDY. PART II. BIBLIOGRAPHY. Kenneth Rapp, Stanley Wallack, and A. M. Moos. July 15, 1950. 190p, Contract AT(30-1)-856. $28.80(ph OTS); $8.40(mf OTS).

Results are presented from an evaluation of the feasibility of utilizing by chemical means the energy contained in fission products. It was concluded that several radiochemical reactions exhist, the products of which have intrinsic value. General aspects of the problem are discussed. The radiochemical production of hydrogen from water is discussed in detail and cost data are compared with conventional methods. The use of phosphors in radiochemical systems is also discussed. (318 references.) (C.H.)

1463

REACTIONS OF METHANE WITH IODINE ACTIVATED BY RADIATIVE NEUTRON CAPTURE. II. Gerrit Levey and John E. Willard (Univ. of Wisconsin, Madison). J. Chem. Phys. 25, 904-7(1956) Nov.

Further experiments have been conducted to clarify the mechanism of the unique reaction whereby I^{128} freshly formed by the $I^{127}(n,\gamma)I^{128}$ process is able to replace hydrogen in methane ($I^{128} + CH_4 \rightarrow CH_3I + H$). They show that the yield of CH_3I^{128} is decreased by the presence of the inert gases He, A, and Xe but not to the extent which would be the case if the activation energy for the reaction were supplied solely by kinetic energy of the I^{128}. I_2, CH_3I, C_2H_5I, C_3H_7I and NO, which have lower ionization potentials than that of the I atom are all more effective than the inert gases in reducing the yield. The organic yield of I^{128} is higher when alkyl iodides are used as the source of iodine than when I_2 is used. The ability of the freshly formed I^{128} to react with C_2H_6 or C_6H_6 is much less than with CH_4. Reactions of I_2 with CH_4 sensitized by A and Xe occur when several hundred mm of the inert gas is present during exposures to $10^5\gamma$ or more of gamma radiation. (auth)

1464

RECOIL ENERGY EFFECTS IN THE HOT ATOM CHEMISTRY OF IODINE. Robert H. Schuler (Brookhaven National

Lab., Upton, N. Y.) and Charles E. McCauley (St. Peter's Coll., Jersey City, N. J.). J. Chem. Phys. 25, 1080-1(1956) Nov.

Direct comparison of I^{126} and I^{128} activities produced in I_2 by (n,2n) and (n,γ) activation is made. Retention of the two is identical in $CH_3CH_2CH_2I$ but retention of the I^{126} isotope is appreciably greater for solutions of I_2 in cyclohexane. The increased retention for the more energetic recoil atom can result from the increased probability of reaction of the hot atom with the higher fragment background. (T.R.H.)

1465

INDIRECT ACTION OF RADIATION ON THE —NH—CH_2— LINKAGE IN DIETHYLAMINE (A MECHANISM FOR RADIATION-INDUCED DECOMPOSITION OF THE PEPTIDE CHAIN). Michael E. Jayko and Warren M. Garrison (Univ. of California, Berkeley). J. Chem. Phys. 25, 1084(1956) Nov.

A new mechanism is proposed for the radiation-induced cleavage of peptide chains. (T.R.H.)

1466

RECOIL SEPARATION OF ISOTOPES. K. H. Sun and F. A. Pecjak (Westinghouse Electric Corp., East Pittsburgh). Nucleonics 14, No. 11, 122 & 124-6(1956) Nov.

A recoil collection technique is described which is applicable to fast neutrons, protons, α particles, and particularly endoenergetic nuclear reactions. (T.R.H.)

RADIATION EFFECTS

1467

CALCULATIONS OF THE YIELDS OF RADIATION-INITIATED POLYMERIZATION AS A FUNCTION OF SOURCES DISTRIBUTION. Michel Magat and Lydia Reinisch (Laboratoire de Chimie-Physique de la Faculte des Sciences, Paris). Intern. J. Appl. Radiation Isotopes 1, 194-207(1956) Nov. (In French)

In order to calculate the yield of radiation-initiated polymerisation, it is necessary to know the irradiation field of the used sources. In the present paper this calculation was made for the single linear Co^{60} and Cs^{137} sources, for systems of 2, 4, and 7 linear sources, for hollow cylinders of various diameters, and for hollow spherical sources. Determination was made of corresponding yields and of molecular-weight distribution of the polymer for 1 and 7 linear sources. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

1468 AEC-tr-2662

THE FREQUENCY OF RARE EARTHS IN ANIMAL BONES. Hermann Lux. Translated from Z. anorg. u. allgem. Chem. 240, 21-30(1938). 16p.

X-ray spectrographic analysis of bone samples showed the presence of trace amounts of Sc, Y, La, Ce, Nd, Gd, and Dy. The rare earths in bone ash were found to be about 1,000 times less frequent than in the earth's crust. (C.H.)

1469

COPRECIPITATION OF RARE EARTH IODATES WITH THORIUM IODATE PRECIPITATED FROM HOMOGENEOUS SOLUTION. Kenneth J. Shaver (Monsanto Chemical Co., Miamisburg, Ohio). Anal. Chem. 28, 2015-19(1956) Dec.

The separation of Th from rare earths by precipitation of $Th(IO_3)_4$ from homogeneous solution is evaluated. The extent of coprecipitation is given when Th is precipitated in the presence of the rare earths; La, Pr, Pm; and the related elements, Y and Sc. The extent of coprecipitation is determined by the use of radioactive tracers of these elements. The distribution of rare earths with Th follows the logarithmic or heterogeneous distribution law. It is concluded that trivalent rare earths coprecipitate with $Th(IO_3)_4$ by a type of isomorphous replacement within the $Th(IO_3)_4$ lattice. A correlation is given between ionic radii and extent of coprecipitation. (auth)

1470

THE PREPARATION, CRYSTAL STRUCTURE AND SOME PROPERTIES OF SmN, EuN, AND YbN. H. A. Eick, N. C. Baenziger, and L. Eyring (State Univ. of Iowa, Iowa City). J. Am. Chem. Soc. 78, 5987-9(1956) Dec. 5.

Samarium nitride, EuN and YbN were prepared by the direct combination of the metals with N_2. All three were found to have a NaCl-type structure with the following lattice parameters: 5.0481 ± 0.0008, 5.007 ± 0.004 and 4.7852 ± 0.0008 A., respectively. A differential thermal analysis-thermogravimetric analysis of SmN in an atmosphere of moist nitrogen is reported. The decomposition curves showed a plateau indicating a thermally stable compound corresponding to a molecular weight of SmO(OH). (auth)

1471

MASS SPECTROMETRIC STUDY OF PHASE CHANGES IN ALUMINUM, PRASEODYMIUM, AND NEODYMIUM. Robert G. Johnson, Donald E. Hudson, Wallace C. Caldwell, Frank H. Spedding, and William R. Savage (Iowa State Coll., Ames). J. Chem. Phys. 25, 917-25(1956) Nov.

A sensitive method has been developed for measuring rapidly the latent heat of vaporization or sublimation of metals of low volatility. Atoms from the saturated vapor emerge from a small Knudsen-type effusion cell and impinge upon a hot filament. A fraction of the incident atoms re-evaporate from the filament as ions and are detected by a mass spectrometer. The Clausius-Clapeyron equation is used to obtain the latent heat from the dependence of ion current upon cell temperature. Application has been made to Al, Pn, and Nd. The work on Al yielded an enthalpy of sublimation at 298°K of 78.0 ± 0.4 kcal/M. Some anomalous behavior was observed in the rare earths. Preliminary molar enthalpy values are: Pr, 79.3 ± 2.0 kcal (vaporization at 1380°K); Nd, 70.6 ± 2.0 kcal (vaporization at 1348°K) and 74.1 ± 2.0 kcal (sublimation at 1236°K). An estimate of the heat of fusion of Nd yielded 3.5 ± 1.0 kcal/M. The method also provided a convenient measurement of first-order phase transition temperatures. The melting points of Pr and Nd were found to be 1192 ± 2°K and 1292 ± 2°K respectively. In addition, a solid-to-solid phase transition was found in Nd at 1142 ± 2°K. (auth)

1472

STRUCTURAL CHEMISTRY OF THE ALKOXIDES. PART VIII. ISOMERIC BUTOXIDES AND PENTYLOXIDES OF NIOBIUM. D. C. Bradley, B. N. Chakravarti, and W. Wardlaw (Birkbeck Coll., London). J. Chem. Soc. 4439-42 (1956) Nov.

The isomeric butoxides and pentyloxides (excepting the tert.-alkoxides) of Nb have been prepared and their molecular weights in boiling benzene and their volatilities have been determined. The physicochemical properties of the Nb alkoxides are compared with those of the corresponding Ta derivatives. In contrast to Ta, which forms stable penta-tert.-alkoxides, niobium gives oxy-derivatives with tertiary alkoxides and no pentra-tert.-alkoxides of Nb could be isolated. This difference is discussed from the theoretical standpoint and is related to the lower thermal stability of n-alkoxides of Nb. (auth)

1473

THE HEAT OF COMBUSTION OF ERBIUM. Elmer J. Huber, Jr., Earl L. Head, and Charles E. Holley, Jr. (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 60, 1582-4(1956) Nov.

The heat of combustion of Er metal is determined as

$\Delta E_{25°} = -1893.6 \pm 1.9$ kj/mole, corrected. The heat of formation of Er_2O_3 is calculated as $\Delta H_{25°} = -1897.8 \pm 1.9$ kj/mole. (T.R.H.)

1474

SOLUTIONS OF EUROPIUM AND YTTERBIUM METALS IN LIQUID AMMONIA. James C. Warf and William L. Korst (Univ. of Southern California, Los Angeles). J. Phys. Chem. 60, 1590-1(1956) Nov.

Both Eu and Yb dissolve in liquid NH_3 at −78°. The Eu was more soluble, and Sm was apparently insoluble. The heat of solution of Eu was estimated at 26 kcal/g atom. The solubility of Am in liquid NH_3 is discussed. (T.R.H.)

Refer also to abstract 1443.

SEPARATION PROCEDURES

1475 AECU-3375

Michigan. Univ., Ann Arbor.

NUCLEAR CHEMICAL RESEARCH RADIOCHEMICAL SEPARATIONS AND ACTIVATION ANALYSIS. Progress Report No. 5 [for] November 1955−October 1956. Dept. of Chemistry. Nov. 1, 1956. 91p. Project No. 7. Contract AT(11-1)-70. $0.50(OTS).

The present facilities at the University of Michigan for research in nuclear chemistry are described. The design and performance of x-ray proportional counter, 4-π counters, gold evaporator, metal evaporator and thin film gage, and a hollow scintillator β-ray spectrometer are presented. The half life of P^{32} has been re-determined to be 14.221 ± 0.005 days. The chemical separation of Y and In is described. The development and evaluation of radiochemical separation procedures for Ba, Ca, Sr, Ag, and In are discussed. The use of Sb−Be sources in activation analysis is discussed. (For preceding period see AECU-3116.) (W.L.H.)

1476 CF-56-8-132

Oak Ridge National Lab., Tenn.

HRP-HYDRAULIC CYCLONE STUDY FOR LIQUID-SOLID SEPARATION. P. A. Haas, E. O. Hurmi, M. E. Whatley, and J. R. Engel. Aug. 7, 1956. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

It is concluded that hydroclones for separation of 1 to 10 μ particles from reactor coolants or fuel solutions are practical. Even in high-temperature, high-pressure, corrosive systems hydroclones are more durable and trouble-free than present equipment. Heavy phase concentration factors up to 4,500 were obtained in the studies. (T.R.H.)

1477 JENER-45

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

ON THE ISOLATION OF PLUTONIUM BY A SOLVENT EXTRACTION PROCEDURE. Period Covered: October 1955−May 1956. D. H. W. den Boer and Z. I. Dizdar. Oct. 1956. 20p.

A procedure for the separation of Pu from neutron-irradiated U by solvent extraction is presented. The starting material was U rods from JEEP containing ~5 mg Pu per kg U. The Pu and U were extracted from the fission products with a 30 vol. % TBP-70 vol. % kerosene solution. The Pu was reduced and stripped into the aqueous phase by aqueous hydrazine solutions. A final washing with TBP-kerosene removed most of the U. A complete separation of the layers was accomplished by centrifugation. (W.L.H.)

1478 NYO-1140

Vitro Mfg. Co., Pittsburgh.

PROBLEMS OF LEACHING AND DIGESTION OF URANIFEROUS SLAGS AND ALLOYS. Progress Report No. 6 [for] October 1951. July 1952. Decl. Nov. 13, 1956. 8p. Contract AT(30-1)-1241. $1.80(ph OTS); $1.80(mf OTS).

Increasing the slurry density of calcined slag and dolomite-liner digest solutions decreased the U level and increased the F level in the dried $(NH_4)\ UO_4$ precipitate. An acceptable product was obtained from Bird residues by $H_2SO_4-NaNO_3$ digestion, filtration, and precipitation of $Na_2U_2O_7$ from the filtrate by NaOH neutralization. This process could not be applied to Hershaw press cake. Additional data on the conditions necessary for adequate U recovery from bronze flux cake by Na_2CO_3 pressure digestion were obtained. Ion-exchange-resin treatment of Vitro ammoniacal effluent waste gave inadequate U recovery. Almost 100% recovery was obtained with phosphorylated cotton. (J.E.D.)

1479 NYO-1141

Vitro Mfg. Co., Pittsburgh.

PROBLEMS OF LEACHING AND DIGESTION OF URANIFEROUS SLAGS AND ALLOYS. Progress Report No. 7 [for] November 1951. July 1952. Decl. Nov. 13, 1956. 12p. Contract AT(30-1)-1241. $3.30(ph OTS); $2.40 (mf OTS).

Dilution and variation of the pH of precipitation of U-bearing slag and dolomite-liner digest liquors did not affect significantly the F carry-over of the salts precipitated by NH_4IH addition. A satisfactory soda salt was obtained from Harshaw press cake by $H_2SO_4-NaNO_3$ digestion Na_2CO_3 neutralization and digestion, and NaOH precipitation. Soda salt precipitated directly from the H_2SO_4 digest liquors had too high halogen content. Partial neutralization of excess free acid in plant digest slurries did not increase the U_3O_8 content of the insolubles; direct filter pressing therefore is possible. Optimum roasting time and temperature, pressure, and Na_2CO_3 concentration in U recovery from bronze flux cake were determined. (J.E.D.)

1480 NYO-1142

Vitro Mfg. Co., Pittsburgh.

PROBLEMS OF LEACHING AND DIGESTION OF URANIFEROUS SLAGS AND ALLOYS. Progress Report No. 8 [for] December 1951. July 1952. Decl. Nov. 13, 1956. 7p. Contract AT(30-1)-1241. $1.80(ph OTS); $1.80(mf OTS).

Detailed processing data were obtained on batches of dried unroasted U-bearing dolomite-liner scrap carried through the entire "wet process" procedure. Partial neutralization to expedite plant digest slurries was found feasible. Settling rates of nonroasted liner slurries of various densities were observed. The time required for ball milling of liner slurries and dried liner to various mesh sizes was determined. Additional pilot plant data were obtained on recovery of U from bronze flux cake by Na_2CO_3 pressure digestion. (J.E.D.)

1481 NYO-1143

Vitro Mfg. Co., Pittsburgh.

PROBLEMS OF LEACHING AND DIGESTION OF URANIFEROUS SLAGS AND ALLOYS. Progress Report No. 9 [for] January 1952. July 1952. Decl. Nov. 13, 1956. 9p. Contract AT(30-1)-1241. $1.80(ph OTS); $1.80(mf OTS).

Plant-scale and laboratory tests of partial neutralization of U-bearing slag and liner digest slurries were carried out; detailed data are tabulated. Two additional batches of liner were carried through the complete process to obtain design weights and volumes. Satisfactory U recovery was indicated in precipitation from slag digest liquors as $UO_2NH_4PO_4$. Settling data on ball-milled liner slurries were determined. The effect of pH on volume of crude $(NH_4)_2UO_4$ precipitates was studied. Optimum calcination temperatures, times, and Na_2CO_3 concentrations for U recovery from bronze flux cake were investigated. Con-

tinuous precipitation of $(NH_4)_2UO_4$ from liner digest liquor in the presence of vigorous agitation resulted in an acceptable product. (J.E.D.)

1482 NYO-1144
Vitro Mfg. Co., Pittsburgh.
PROBLEMS OF LEACHING AND DIGESTION OF URANIFEROUS SLAGS AND ALLOYS. Progress No. 10 [for] February 1952. July 1952. Decl. Nov. 13, 1956. 13p. Contract AT-(30-1)-1241. $3.30(ph OTS); $2.40(mf OTS).

Pilot-plant processing data were obtained on the water leaching, calcination and autoclave-digestion steps in the recovery of U from bronze flux cake. The use of dilute NH_4OH to precipitate (NH_4UO_4) on a batch production scale gave only slightly better U and F levels than the use of concentrated NH_4OH. U extraction from acid digest liquors as $UO_2NH_4PO_4$ was not satisfactory with all U-bearing dolomite liner materials. Limits were placed on the pH range permitting formation of ammonium precipitates with the best settling characteristics. The influence of pH on continuous precipitation of $(NH_4)_2UO_4$ from various digest liquors was studied. (J.E.D.)

1483 NYO-1149
Vitro Mfg. Co., Pittsburgh.
PROBLEMS OF LEACHING AND DIGESTION OF URANIFEROUS SLAGS AND ALLOYS. Progress Report No. 15 [for] August 1952. H. Fleck and John E. Summers. Aug. 15, 1952. Decl. Nov. 13, 1956. 11p. Contract AT(30-1)-1241. $3.30(ph OTS); $2.40(mf OTS).

The applicability and refinement of various procedures for the treatment and digestion of C-slags and other uraniferous residues for recovery of U values were investigated. (auth)

1484 NYO-1158
Virto Mfg. Co., Pittsburgh.
PROBLEMS OF REFINING URANIFEROUS RESIDUES. Progress Report No. 24 [for] April 1953. H. Fleck and J[ohn] E. Summers. May 15, 1953. Decl. Nov. 13, 1956. 18p. Contract AT(30-1)-1241. $3.30(ph OTS); $2.40 (mf OTS).

An investigation of the applicability and refinement of various procedures for the treatment and digestion of C slags and other uraniferous residues for the recovery of U values; extraction of U from feed materials production center sump cake, using mineral acid digestion and ammonium precipitation; digestion and refining of bronze flux; development of processes for the extraction of U from Na_2CO_3 residues resulting as a by-product of pitchblende purification; and the recovery of U from the current Na_2CO_3 residues by a process of UAP precipitation is outlined. (J.E.D.)

1485 NYO-1162
Vitro Mfg. Co., Pittsburgh.
PROBLEMS OF REFINING URANIFEROUS RESIDUES. Progress Report No. 26 [for] June 1953. H. Fleck and J[ohn] E. Summers. July 15, 1953. Decl. Nov. 15, 1956. 16p. Contract AT(30-1)-1241. $3.30(ph OTS); $2.40 (mf OTS).

An investigation is presented on the applicability and refinement of various procedures for the treatment and digestion of C slags and other uraniferous residues for recovery of U values. Recovery of U from bronze flux and from various residues resulting from Na_2CO_3 digestion of U-bearing materials to reduce the U_3O_8 content of the residues below 0.05% is discussed. (J.E.D.)

1486 NYO-1163
Vitro Mfg. Co., Pittsburgh.
PROBLEMS OF REFINING URANIFEROUS RESIDUES. Progress Report No. 27 [for] July 1953. H. Fleck and J[ohn] E. Summers. Aug. 15, 1953. Decl. Nov. 13, 1956. 14p. Contract AT(30-1)-1241. $3.30(ph OTS); $2.40(mf OTS).

Investigation of the applicability and refinement of various procedures for the treatment and digestion of C Slags and other uraniferous residues for recovery of U values, placing emphasis on methods adaptable to the Canonsburg Plant with minimum change of equipment is reported. A study was made of the recovery of U from bronze flux placing emphasis on processes which will not chemically alter the Cu and Sn media, and of methods of recovery of U from various residues, resulting from Na carbonate digestion of miscellaneous U bearing materials, to reduce the U_3O_8 content of the residues below 0.05%. (J.E.D.)

1487 NYO-6084
Standard Oil Development Co. Esso Labs., Linden, N. J.
BIBLIOGRAPHY OF DEUTERIUM SEPARATION METHODS. William P. Drews. Dec. 4, 1953. Decl. Oct. 28, 1955. 65p. Contract AT(30-1)-1407. (SOA-159).

1488 WIN-48
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
PRECIPITATION OF MOLYBDENUM FROM ION EXCHANGE FEEDS BY NEUTRALIZATION IN THE PRESENCE OF IRON. Paul J. Magno. Nov. 15, 1956. 38p. Contract AT(49-6)-924. $6.30(ph OTS); $3.00(mf OTS).

The removal of Mo from acid leach liquors by neutralization in the presence of Fe has been evaluated as a method of decreasing the concentration of Mo to a tolerable level in ion exchange feeds. Such variables as acid concentration, Fe to Mo ratio, temperature, and concentration of silicate and Al in the leach liquor were examined in order to develop the optimum conditions for the precipitation of Mo. The precipitation procedure was tested on leach liquors from Ambrosia Lake District ore and from several lignite ores. Leaching tests made on lignite ores indicate that Fe and Mo can be precipitated during the leaching by suitable control of the acidity. (auth)

1489
ADSORPTION OF URANIUM ON CLAY MINERALS. P. T. Davey and T. R. Scott (Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia). Nature 178, 1195(1956) Nov. 24.

A study is presented of the absorption of U on clay-like minerals (montmorillonite, vermicubite, and halloysite) to investigate the possibility that dissolved U may be reabsorbed by an ion exchange mechanism on the clay minerals in an ore, thereby leaving a residue relatively high in U despite the usual vibration and washing procedures. (W.L.H.)

SPECTROSCOPY

1490
THE INFRARED SPECTRA OF AROMATIC COMPOUNDS. IV. THE NITRO VALENCE VIBRATIONS IN p-DISUBSTITUTED NITROBENZENES. Robert D. Kross and Velmer A. Fassel (Iowa State Coll., Ames). J. Am. Chem. Soc. 78, 4225-9(1956) Sept. 5.

The characteristic nitro asymmetric and symmetric frequencies of para-substituted nitrobenzenes are correlated with structure related parameters which are sensitive to the electronic effect of the para-substituent on the nitrobenzene nucleus. It is shown that molecular dipole moments, as well as Hammett's σ constants for the para groups, yield straight line curves when plotted against the corresponding nitro asymmetric frequency. A plot of nitro asymmetric vs. symmetric frequency yields a discontinuous curve, the reasons

for which are discussed. Evidence is also presented which places the C–NO_2 stretching frequency in aromatic nitro compounds in the 1300/cm. region. (auth)

SYNTHESES

1491 UCRL-3504
California. Univ., Berkeley. Radiation Lab.
FORMATION OF RADIOACTIVE CITRULLINE DURING PHOTOSYNTHETIC $C^{14}O_2$-FIXATION BY BLUE-GREEN ALGAE. Pekka Linko, O. Holm-Hansen, J. A. Bassham, and M. Calvin. Aug. 28, 1956. 15p. Contract W-7405-eng-48. $0.15(OTS).

1492 AEC-tr-2666
ENZYMIC TRANSFER OF THE PHOSPHATE GROUP WITH RIBONUCLEIC ACID ON FRUCTOSE MONOPHOSPHATE. S. E. Bresler and Kh. M. Rubina. Translated from Biokhimiya 20, 740-8(1955). 22p.

Data are reported from a tracer study, employing P^{32}, of the conditions involved in the enzymic process of transfer of active phosphate groups from adenosine triphosphate to ribonucleic acid. (C.H.)

TRANSURANIC ELEMENTS AND COMPOUNDS

Refer to abstract 1477.

URANIUM AND URANIUM COMPOUNDS

1493 HW-22629
Hanford Works, Richland, Wash.
ESTIMATION OF FISSION PRODUCT BETA ACTIVITY IN URANIUM CONTAINING U-237 AND UX_1. J. E. Meinhard. Nov. 6, 1951. Decl. Nov. 30, 1956. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

It has been found that a mixture of acetone and ethyl ether containing nitric acid will wash U and 98 per cent of its natural daughters from a cellulose pulp column. Eight per cent of a "fission product" spike also comes through in this fraction but may be reduced by suitable modifications. A second development with 2M HCl washes out 83% of the original spike activities, and an additional 3% is obtained by extruding the column, ashing, and counting the ash. A tentative procedure is given and recoveries tabulated. (auth)

1494
ROASTING TO REMOVE FLUORIDES FROM AMMONIUM DIURANATE. E. R. Johnson, E. O. Rutenkroger, H. M. Beers, and A. B. Kreuzmann (National Lead Co. of Ohio, Fernald). Chem. Eng. Progr. 52, 474-6(1956) Nov.

Fluoride contamination in $(NH_4)_2U_2O_7$ formed in a U recovery process can be volatilized by calcination above 1,250°F. As a result of tests described, it is concluded that this calcination can be carried out more effectively in a fluidized bed reactor than in either a muffle furnace or a raked-tray-type roaster. (auth)

1495
ORGANIC COMPOUNDS OF URANIUM. VI. URANIUM(VI) ALKOXIDES. R. G. Jones, E. Bindschadler, D. Blume, G. Karmas, G. A. Martin, Jr., J. R. Thirtle, F. A. Yeoman, and H. Gilman (Iowa State Coll., Ames). J. Am. Chem. Soc. 78, 2030-2(1956) Dec. 5.

Uranium(VI) ethoxide, a dark-red, distillable liquid, was prepared by oxidation of the sodium ethoxide complex of uranium(V) ethoxide with benzoyl peroxide. Other less efficient oxidizing agents were oxygen, bromine, and lead tetraacetate. Other related uranium(VI) alkoxides were synthesized by the benzoyl peroxide method, but more conveniently they were obtained by exchange reactions between uranium(VI) ethoxide and various alcohols. The uranium(VI) alkoxides, although relatively volatile, were unstable toward heat. (auth)

1496
ORGANIC COMPOUNDS OF URANIUM. V. DERIVATIVES OF URANIUM(V) ALKOXIDES. R. G. Jones, E. Bindschadler, D. Blume, G. Karmas, G. A. Martin, Jr., J. R. Thirtle, and H. Gilman (Iowa State Coll., Ames.). J. Am. Chem. Soc. 78, 6027-9(1956) Dec. 5.

Uranium(V) ethoxide reacts with sodium ethoxide, calcium ethoxide and aluminum ethoxide to give the salt-like compounds $NaU(OC_2H_5)_6$, $Ca[U(OC_2H_5)_6]_2$ and $Al[U(OC_2H_5)_6]_3$, respectively. Uranium(V), 2,2,2-trifluoroethoxide, forms a series of addition complexes with aliphatic amines. Compounds of the type $U(OR)_4Cl$, $U(OR)_3Cl_2$ and $U(OR)_2Cl_3$ are obtained by reactions of $U(OR)_5$ with hydrogen chloride. (auth)

Refer also to abstract 1426.

WASTE DISPOSAL

1497 AERE-C/R-1294
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE COOLING OF UNDERGROUND FISSION WASTES. J. K. Perring. Nov. 9, 1953. Decl. Jan. 10, 1956. 12p.

A method suggested for the disposal of waste fission products involves their adsorption in clay and burial in deep bore-holes. Approximate calculations are given by which the temperature of the clay at any time can be found. The results are so arranged that answers can easily be obtained for any mixture of the more common fission products. (auth)

1498
RADIOACTIVITY IN STREAM POLLUTION. R. C. Palange, G. G. Robeck, and C. Henderson (Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio). Ind. Eng. Chem. 48, 1847-50(1956) Oct.

The manufacture of fissionable materials, increasing peacetime uses for atomic energy products, and projected development of nuclear power facilities introduce new problems into the field of environmental sanitation. One of these problems, of direct concern to many state and local health departments and to others, is the possible contamination of surface streams. The effects of low-level radioactive effluents on physical, chemical, and biological characteristics of surface waters were discussed along with techniques used to approach and define this type of problem. (auth)

ENGINEERING

1499 AD-106844
Chemical Corps Engineering Agency, Army Chemical Center, Md.
PROCEEDINGS OF THE FIRST ANNUAL STATISTICAL ENGINEERING SYMPOSIUM, APRIL 28-29, 1955. David R. Howes and T. M. Vining. Sept. 2, 1955. 97p.

Papers are presented on design for service, continuous sampling procedures, some methods of analyzing factorial experiments with numerical factors, some aspects of experimental design, reliability of guided missiles, problems arising in engineering investigations, examples of designed experiments in industry, statistical techniques in surveillance of ordnance ammunition, and on the statistical engineering program in the Chemical Corps Engineering Agency. (J.H.M.)

1500
ELECTRICALLY OPERATED 6-INCH HIGH-VACUUM VALVE. Alfred R. Taylor (Univ. of California Radiation Lab., Livermore). Nucleonics 14, No. 11, 113(1956) Nov.

HEAT TRANSFER AND FLUID FLOW

1501 BMI-1141
Battelle Memorial Inst., Columbus, Ohio.
STUDIES OF FLOW DISTRIBUTION IN THE CORE OF A QUARTER-SCALE FLOW MODEL OF THE PWR REACTOR. Herbert R. Hazard and John M. Allen. Oct. 19, 1956. 50p. Contract W-7405-eng-92. $0.35(OTS).

Distribution of flow among fuel clusters in a quarter-scale flow model of the PWR reactor was studied using air flow to simulate coolant flow. Under all power-plant operating conditions the flow through all clusters was within 3 per cent of the average flow for the region in which the cluster was located. (auth)

1502 AEC-tr-2546
ON THE ACOUSTIC BOUNDARY LAYER NEAR RIGID WALLS. Lothar Cremer. Translated from Arch. Elektr. Übertag., Dtsch. 2, 136-9(1948). 8p.

The Kirchoff method is considered in the mathematical treatment of the acoustic boundary layer near rigid walls. (J.H.M.)

1503
HEAT TRANSFER RATES—CROSS FLOW ON WATER THROUGH A TUBE BANK AT REYNOLDS NUMBERS UP TO A MILLION. O. E. Dwyer, T. V. Sheehan, Joel Weisman, F. L. Horn (Brookhaven National Lab., Upton, N. Y.) and R. T. Schomer (Gibbs and Cox Co., New York). Ind. Eng. Chem. 48, 1836-46(1956) Oct.

Heat transfer coefficients have been obtained at high Reynolds numbers for cross flow of high temperature, high pressure water through a bank of 200 tubes, 0.810 inch o.d. and spaced on an equilateral triangular grid $1^{9}/_{32}$ inches between centers. In the range investigated, the coefficients were considerably greater than those predicted by extrapolation of the Colburn equation. In the Reynolds number range 10^5 to 10^6, the coefficient varies approximately as the 0.8 power of the Reynolds number instead of 0.6, as indicated by the Colburn equation. The effects of pressure, heat flux, and flow rate on the inception of nucleate boiling and on the heat transfer rate in the transition stage between nonboiling and full surface boiling were studied. Pressure drop results were consistent with data obtained at lower Reynolds numbers. (auth)

1504
MECHANICAL INDUCED-DRAUGHT COOLING TOWERS. Derek J. Tow. Nuclear Eng. 1, 331-3(1956) Nov.

A comparison was made of the suitability of mechanical and natural draft cooling towers. The power cost for water circulation and cooling tower fan drive for mechanical cooling is compared to the depreciation, interest and maintenance cost of the condenser, cooling-water pipework, water-circulating pumps and cooling tower complete with pond, foundations and operating gear for the natural draft cooling towers. (F.S.)

MATERIALS TESTING

1505 AGARD-2
North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.
THERMAL PROBLEMS IN AIRCRAFT STRUCTURES. N. J. Hoff. June 195[5]. 33p.

Problems in structural design and analysis of aircraft when high supersonic speeds cause elevated temperatures in the structure are summarized. Experimental methods and equipment being used by various U. S. research organizations are described. (auth)

1506 AGARD-3
North Atlantic Treaty Organization, Paris.
Advisory Group for Aeronautical Research and Development.
AIRCRAFT STRUCTURES RESEARCH AT ELEVATED TEMPERATURES. John E. Duberg. Sept. 1955. 31p.

Test techniques used to explore the aerodynamic heating problems of aircraft structures are reviewed. Experimental results are given, and model scaling for testing of structures at high temperatures is discussed. (J.H.M.)

1507 WAPD-TM-16
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SHOCK TESTING INSTRUMENTATION. F. Card. July 23, 1956. 20p. Contract AT-11-1-GEN-14. $0.20(OTS).

Shock load testing involving high strain rates and short contacts times with a load magnitude such that the plastic strain is of the same order as the elastic strain or less, was evaluated and instrumentation used was described. (F.S.)

TRACER APPLICATIONS

1508 NP-6153
Canada. Dept. of Mines and Technical Surveys. Mines Branch.
EXPERIMENTS ON THE POSSIBLE USE OF RADIOACTIVE DYNAMITE IN MINES. G. G. Eichholz, A. O. Smith, and A. Bauer. Sept. 24, 1956. 14p. (TR-134/56).

Radioactive dynamite has been prepared by introducing a small amount of Sb^{124} into the explosive. Test work is described on the effectiveness of this tracer, radiation levels in its neighborhood, and different methods of application. Factors determining the choice of isotope, amount of activity, and over-all cost of this process are discussed. (C.H.)

VACUUM SYSTEMS

1509 CF-56-10-82
Oak Ridge National Lab., Tenn.
IN-PILE LOOP VALVE PROBLEM. A. R. Olsen. Oct. 18, 1956. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mc OTS).

Standard Autoclave Engineering high pressure valves with type 304 stainless steel bodies and type 420 stainless steel stems were examined and reported separately for the cause of failure. Metallographic examinations were reported and the results discussed. (J.E.D.)

1510 IGRL-T/C-25
EVOLUTION OF GAS AND PERMEABILITY TO GAS OF CONSTRUCTIONAL METALS FOR VACUUM SYSTEMS. E. Waldshmidt. Translated by J. Standring from Metall 8, 749-59(1954). 16p.

Physical phenomena which affect the suitability of metals for construction materials in vacuum systems are reviewed. Methods are presented for calculating the gaseous saturation pressure for metals. Topics discussed include the adsorption and absorption of gases by metals, the solubility and diffusion of gases in metals, the permeability of metals to gas, and capillary permeability of metals for gases. Tabulated data are included on the characteristics properties affecting gas adsorption for Al, Ba, Ce–La, Mg, Th, U, Fe, and K; examples of gas content of commercial metals and the

composition of the gas evolved at various extraction temperatures; and the permeability of Fe treated with various protective layers against corrosion under water and 25% NaCl solution. (56 references.) (C.H.)

1511

O-RING MOUNTING OF BELLOWS. M. L. Randolph, M. Slater, and D. L. Parrish (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 27, 878-9(1956) Oct.

Details are given for combining metallic bellows with O-ring seals to facilitate motions within vacuum or pressure systems. (J.H.M.)

MINERALOGY, METALLURGY, AND CERAMICS

1512 HW-41307

[Hanford Atomic Products Operation, Richland, Wash.]. A CUTTING TORCH FOR SLITTING LONG TUBES FROM THE INTERIOR. L. C. Lemon. Feb. 2, 1956. Changed from OFFICIAL USE ONLY Nov. 1, 1956. 3p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A study was made of the development and design of a cutting torch which would slit Al tubes in a graphite matrix without damaging the graphite. (auth)

CERAMICS AND REFRACTORIES

1513 CF-56-11-130

Oak Ridge National Lab., Tenn.

PROCEDURES DEVELOPED AT THE OAK RIDGE NATIONAL LABORATORY FOR FABRICATING STAINLESS STEEL CLAD B_4C-Cu COMPOSITE PLATES. M. R. D'Amore. Nov. 28, 1956. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The techniques developed for fabricating panels of a B_4C–copper cermet clad with stainless steel are summarized. The powder metallurgy procedures employed in the fabrication of B_4C-Cu cores are described. Their designation is Electrolytic Copper Type C and the powders are 70 to 80% −325 mesh. The B_4C powders are designated high-purity B_4C (76% boron minimum). The B_4C particles are ground to −325 mesh prior to use. Dispersions of B_4C particles in Cu are obtained by blending the powders on an oblique blender rotating at 24 rpm. Uniform mixtures have been obtained in batch sizes up to 1 kg by blending for two hr. Batches larger than 1 kg are generally blended four hr. The powders are compacted in hardened steel dies at pressures of 10 to 15 tsi, using stearic acid as a die lubricant. Exceeding these compacting pressures will result in expansion of the cores during sintering due to entrapped gases. The compacted cores are sintered in a dry H atmosphere (−70 dew pt.) between 1550 to 1900°F. The lower temperatures are used for cores containing the highest proportion of Cu (greater than 70 vol. %) to control the shrinkage. Sintering times of one hr have been satisfactory. Longer sintering times result in no significant improvement of the bodies. Coining is done in the same dies at pressures between 33 and 60 tsi. The higher coining pressures are favored since the density and strength of the cores are increased. The density of 20 vol. % B_4C–80 vol. % Cu experimental compacts 1 × 3 × 0.4-in. thick after pressing at 10 tsi, sintering at 1550°F, and coining at 35 tsi has been above 90% of theoretical. (auth)

1514 WADC-TR-55-491

Illinois. Univ., Urbana.

RESEARCH ON ELEVATED TEMPERATURE RESISTANT CERAMIC STRUCTURAL ADHESIVES. Period covered: July 1954 to November 1955. Richard M. Spriggs, Henry G. Lefort, and Dwight G. Bennett. Jan. 1956. 101p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: STRUCTURAL ADHESIVES. Contract AF33(616)-2556. (AD-87327).

Twenty-three ceramic adhesives of the ceramic-oxide, glassy-bond type, including six commercially available enamel frit compositions, were evaluated during the contract period. Evaluation was based, primarily, on the results of room and elevated temperature shear strength tests. Best results were obtained with ceramic adhesive UI 117-50. When used with 28 mesh stainless steel screen as a carrier, this adhesive gave shear strengths of up to 3680 psi when tested at 800°F. Twelve ceramic adhesives of the cermet type were tested in shear at room and elevated temperatures. Of these, only the adhesive which contained 30% metallic Co incorporated in a Pb borosilicate glass matrix appeared to offer promise. Thirteen ceramic adhesives of the air-setting, temperature-resistant type were also evaluated. Adhesive A-1 was the only air-setting adhesive which approached the target property of 1000 psi at 1000°F, giving shear strengths of up to 1400 psi at 1000°F after a selected curing treatment to 600°F. Its resistance to moisture, however, was quite low. The oxychloride and oxysulfide adhesives investigated developed nominal sheet strengths of 200 to 250 psi at room temperature and maintained these strengths to an upper temperature limit of 600°F. (auth)

1515 WADC-TR-56-250

Marquardt Aircraft Co., Van Nuys, Calif.

SUMMARY OF DEVELOPMENT AND EVALUATION OF INSULATING TYPE REFRACTORY COATINGS. Period Covered: May 15, 1955 to May 15, 1956. S. Sklarew, C. A. Hauck, and A. V. Levy. Oct. 1956. 126p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-2957. (AD-110410).

Initial development of metal-reinforced refractory coatings to provide thermal insulation to aircraft structural members operating in the temperature range 2000 to 3000°F is reported. Reinforced refractories 0.080 to 0.15-in. thick, providing thermal drops of 5 to 10°F per 0.001 in. of thickness have been successfully tested in small scale. These reinforced coatings averaged half the density of steel. (auth)

1516 AEC-tr-2671

INVESTIGATION OF THE EQUILIBRIUM IN THE SYSTEM ZrO_2-C AT HIGH TEMPERATURES. V. S. Kutsev, B. F. Ormont, and V. A. Epel'baum. Translated by V. Beak from Doklady Akad. Nauk S.S.S.R. 104, 567-70(1955). 5p.

Reduction of ZrO_2 with C leads to the formation of oxycarbide of composition ZrC_xO_y and not a carbide ZrC as usually indicated in literature. Under equilibrium conditions in the temperature range 1800 to 2000°K and the pressure range 150 to 1000 mm Hg an oxycarbide of the composition $ZrC_{0.71}O_{0.08}$ is formed. The thermodynamic properties of the oxycarbide formed according to the equation established are different from those ascribed to the fictitious composition ZrC. Prescott's data, quoted in manuals, for the heat and free energy of formation of the carbide (actually the oxycarbide) of zirconium are, in principle, incorrect. This fact should be considered in investigating carbide systems of this type and in using thermodynamic values from manuals which refer to stoichiometric composition. (auth)

CORROSION

1517 HW-42585(Rev.)

Hanford Atomic Products Operation, Richland, Wash.

A STUDY OF HEAT TRANSFER EFFECTS ON ALUMINUM

CORROSION. PART I. D. R. de Halas. Apr. 19, 1956. 25p. Contract W-31-109-Eng-52. $0.25(OTS).

A preliminary study has been made of Al corrosion rates in water under heat transfer conditions. The corrosion rates observed correspond to those expected at the mean temperature of the corrosion product film on the surface. Data are also given on the apparent thermal conductivity of the corrosion product film and the thickness of the film as a function of corrosion. These data allow calculations to be made which give approximate values for aluminum corrosion rates under heat transfer conditions. (auth)

1518
TITANIUM MOVES INTO PROCESS EQUIPMENT. G. T. Bedford, W. J. Weeks, and A. G. Caterson. Chem. Eng. 63, No. 12, 238, 240, 242, 244, 246 & 248(1956) Dec.

A survey of the uses and application of Ti in industry is given. Data are tabulated on the physical properties, mechanical properties, alloys, and corrosion resistance of Ti. (T.R.H.)

1519
THE PASSIVATION OF IRON BY OSMIUM(VIII) OXIDE AND THE ORIGIN OF THE FLADE POTENTIAL. G. H. Cartledge (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 60, 1571-5(1956) Nov.

Osmium(VIII) oxide in dilute aqueous solution was found to raise electrolytic iron to a passive potential. The potential equaled the thermodynamic value for the Os(IV)–Os(VIII) couple under favorable circumstances, but was sensitive to the presence of sulfate and chloride ions of sufficient concentration. The results are discussed in connection with the mechanism of action of other XO_4^{n-} particles previously investigated and the nature of passive potentials. (auth)

METALS AND METALLURGY

1520 CEA-418
France. Commissariat a l'Énergie Atomique, Paris.
UTILIZATION OF VACUUM IN METALLURGY. (Utilisation du Vide en Metallurgie). J. A. Stohr. [1954]. 7p.

Conditions utilizing vacuum for outgassing metals on a manufacturing scale are reviewed. Reactions of dissociation, the study of refractories, methods of heat treatment and vacuum furnaces are reviewed. (F.S.)

1521 KAPL-M-GOW-1
Knolls Atomic Power Lab., Schenectady, N. Y.
ZIRCALOY THIMBLE FOR KAPL-120 LOOP. G. C. Westfall. Aug. 28, 1956. 18p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

An investigation was made of the possibility of extruding a heavy walled Zircaloy tube having an integral coextruded hemispherical tip. The feasibility of making a Zircaloy thimble for the KAPL-120 loop has been established. Since many problems were encountered in the design investigation, additional work is required before a thimble can actually be fabricated. Investigations of material properties, the machining of a closed-end Zircaloy tube, and the joining of a Zircaloy section to a stainless steel section must first be completed. The maximum flux advantage factor for a Zircaloy thimble in the KAPL-120 loop in place of the present stainless steel thimble would be 1.7 ± 20%. (auth)

1522 KAPL-M-SAT-1
Knolls Atomic Power Lab., Schenectady, N. Y.
WELD PENETRATION CHARACTERISTICS OF ATMOSPHERE-MELTED VERSUS VACUUM-MELTED ZIRCALOY. S. A. Toftegaard. Nov. 1, 1956. 8p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Zircaloy melted under an inert gas cover exhibited greater weld penetration than Zircaloy melted in a vacuum. When Zircaloy melted under an inert gas cover was vacuum-annealed prior to welding, the weld penetration decreased. Weld penetration was greater in as-received atmosphere-melted Zircaloy than in atmosphere-melted Zircaloy which had been surface machined before welding. (auth)

1523 LA-1390(Del.)
Los Alamos Scientific Lab., N. Mex.
A DETERMINATION OF THE COEFFICIENT OF THERMAL EXPANSION OF ALPHA PLUTONIUM. R. O. Elliott and R. E. Tate. Mar. 3, 1952. Decl. Feb. 14, 1956. 18p. Contract W-7405-eng-36. $3.30(ph OTS); $2.40(mf OTS).

The coefficient of linear expansion of α–Pu has been determined for the range –180 to +100°C by the silica-tube and dial-indicator method. The value of the expansion coefficient is reported as $\alpha = 48.39 \times 10^{-6} + 0.09588 \times 10^{-6}$ t°C. Included are a detailed description of the apparatus and a discussion of the method. (auth)

1524 SO-2525
General Electric Co. Research Lab., Schenectady, N. Y.
CREEP RUPTURE OF ZIRCONIUM BINARY ALLOYS. J. H. Keeler. Nov. 1956. 29p. Contract W-31-109-Eng-52. (56-RL-1647). $4.80(ph OTS); $2.70(mf OTS).

The creep and rupture behavior of binary alloys of Zr was qualitatively similar to that found for unalloyed Zr. The alloying served only to raise the stress level for creep and rupture to occur. At room temperature and 300°C, low-temperature behavior was observed in which significant amounts of creep occurred only at stresses above the yield stress. Creep deformation became significant at 500°C at relatively low stresses which were much below the yield stress. (auth)

1525 TID-3309
Technical Information Service Extension, AEC.
THORIUM: A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. Oct. 1956. 13p. $0.20(OTS).

This bibliography contains 74 references to unclassified reports covering all aspects of Th except production of Th metal. A report number index is provided. (auth)

1526 WADC-TR-55-454(Pt. 2)
Sylvania Electric Products Inc., Bayside, N. Y.
A STUDY OF FACTORS AFFECTING THE UNIFORM ELONGATION OF TITANIUM AND TITANIUM ALLOYS. [Period covered] March 1954 to June 1955. A. J. Opinsky, L. Sama, and L. L. Seigle. June 1956. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-2352. (AD-97284).

In a study of factors which affect the limit of uniform elongation of Ti and Ti-base alloys, iodide Ti is shown to have the largest uniform elongation. Other materials of the high uniform elongation class generally had low strengths, although the metastable β-alloys did exhibit moderate strength. The much lower values of the sponge alloys (outside of the metastable β-alloy) are ascribed to interstitial contents. The effects of grain size and grain shape are secondary to those of alloying and temperature of test. Strain-induced decomposition of metastable β is shown to be a suitable means of increasing the elongation at maximum load. The other idea of increasing the uniform elongation by strain-induced age hardening is still untested; the apparently most likely system failed to age-harden, or even strain-age harden. In the anisotropy studies, maximum uniform elongation and divergence between yield and ultimate strengths is found in the rolling direction of the sheet. (auth)

1527 WADC-TR-55-495(Pt. I)

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

MEASUREMENTS OF THERMAL PROPERTIES. Report [for the Period] February 21, 1955 to August 10, 1956. I. B. Fieldhouse, J. C. Hedge, J. I. Lang, A. N. Takata, and T. E. Waterman. Aug. 3, 1956. 71p. Project No. 2998; Task title: ATLAS MATERIALS. Contract AF 33 33(616)-2903. (AD-110404).

The objective of this program was the measurement of the high-temperature thermal properties of materials. The materials investigated were electrolytic Cu, grade A Ni, arc melted unalloyed Mo, graphite type 3474D (Speer Carbon Company), graphite type GBE (National Carbon Company), and sintered Ta. The thermal conductivity, specific heat, and linear coefficient of thermal expansion were measured from 1000 to 3000°F or the melting point of the material, whichever was lower. Both the experimental measurements and the results of the conversion of these measurements to the desired physical properties are given. (auth)

1528 WAL-401/250

Watertown Arsenal Lab., Mass.

AN INVESTIGATION OF THE MECHANICAL PROPERTIES OF METAL-ARC WELDED Ti-6%Al-4%V. Daniel M. Daley, Jr. and Carl E. Hartbower. Sept. 12, 1956. 17p. DA Project 592-05-007.

The purpose of this investigation was to evaluate the tensile and notch-bar impact properties of A Ti-6%Al-4%V weld deposit prepared by the inert-gas-shielded W-arc process using a single heat of Ti-Al-V as both filler and base material and the notch-toughness of the heat-affected-zone in Ti-6%Al-4%V as produced by the inert-gas-shielded consumable-electrode process. The properties of the deposited weld metal were evaluated in $\frac{1}{4}$-in. weldments using subsize tensile and impact specimens. The notch-toughness of heat-affected-zone was evaluated in $\frac{1}{2}$-in. weldments by means of the WAL composite impact specimen. The latter specimen consists of a standard V notch Charpy impact specimen cut from a bead-on-plate weldment so that the test area is one-half deposited weld metal and one-half heat-affected base metal. The relative notch-toughness of weld and heat-affected base metal is determined by measuring the lateral deformation occurring in each half of the specimen. Data indicated that Ti-6%Al-4%V will have satisfactory properties in the as-welded condition when using matching filler and base metal. The tensile joint-efficiency was approximately 100% with an ultimate strength of 150,000 psi. The notch-toughness of deposited Ti-Al-V weld metal was considered acceptable at this strength level, and the notch-toughness of heat-affected-zone was found to exceed that of any other commercially-available alpha-beta alloy previously evaluated. (auth)

1529 AEC-tr-2684

MECHANICS AND KINETICS OF MARTENSITE FORMATION WITHOUT DIFFUSION. H. Knapp and U. Dehlinger. Translated by B. N. Clack from Acta Met. 4, 289-97(1956). 11p.

1530 AEC-tr-2692

THE ALLOY OF INDIUM. With Some Critical Remarks on the Book, 'Indium' by M. T. Ludwick. Siegfried Valentiner. Translated by E. L. Poole from Z. Metallkunde 46, 442-9(1955). 16p.

Metallographic investigations of In alloys in relation to the position of In in the periodic system are reviewed, and a selected bibliography is included. (J.H.M.)

1531

MEASUREMENT OF PRESSURES IN THE TITANIUM IODINE SYSTEM USING THE EFFUSION METHOD. A. Herczog (P. R. Mallory and Co., Indianapolis, Ind.) and L. M. Pidgeon (Univ. of Toronto, Canada). Can. J. Chem. 34, 1687-92(1956) Dec.

The equilibrium vapor pressures of TiI_4 and TiI_2, obtained by the simultaneous decomposition and evaporation of TiI_2 in the presence of excess Ti, have been measured over the temperature range 750 to 902°K using the effusion method. Thermodynamic data have been calculated for the equilibrium systems: $2TiI_2(s) = Ti(s) + TiI_4(g)$, $TiI_2(s) = TiI_2(g)$. (auth)

1532

HYDROGEN EMBRITTLEMENT OF COLD-WORKED METALS. R. L. Mills and F. J. Edeskuty (Los Alamos Scientific Lab., N. Mex.). Chem. Eng. Progr. 52, 477-80(1956) Nov.

The embrittlement produced by H_2 at a pressure of 40,000 lb/in.^{2} in cold-worked stainless steels (303, 316, 347, C1020, C1022) and Be-Cu alloy is measured. The austenitic stainless steels and Be-Cu alloy were apparently not embrittled. Embrittlement occurred to varying degrees in the other steels. (T.R.H.)

1533

MELTING TEMPERATURE OF ZINC, CADMIUM, THALLIUM, AND ANTIMONY AT PRESSURES UP TO 30,000 kg/cm^2. V. P. Butuzov, E. G. Ponyatovskiĭ, and G. P. Shakhovskoĭ. (Inst. of Crystallography). Doklady Akad. Nauk S.S.S.R. 109, 519-20(1956) July 21. (In Russian)

1534

DIFFUSION OF BORON, CARBON, AND NITROGEN INTO TRANSITION METALS OF IV, V, and VI GROUPS OF THE PERIODIC SYSTEM. G. V. Samsonov and V. P. Latyshev (Kalinin Moscow Inst. of Non-ferrous Metals). Doklady Akad. Nauk S.S.S.R. 109, 582-5(1956) July 21.

Studies of B and C diffusion into Ti, Zr, Nb, Ta, Mo, and W were made on specimens of pure 99.85% Ti; 99.99% Zr (iodide); and 99.94% Nb; 99.6% Ta (+0.4% Nb); 99.98% Mo; and, 99.9% W. Before saturating with boron (specially purified, amorphous 99.1%B) and carbon (calcinated carbon black 99.8% C) the specimens were annealed to relieve the internal tensions. X-ray analysis of diffusion showed layer formations of TiC, ZrC, Ta_2C, Nb_2C, Nb_2C, W_2C, Mo_2C, TiB_2, TaB_2, NbB_2, Mo_2B, and W_2B. These data were confirmed by chemical analysis coordinated with mean content in the diffusion layer determined from the concentrations of C and B on the boundaries of the corresponding phases. A table of diffusion equations is given. Activation energies of the B, C, and N diffusion into transition metals of IV, V, and VI groups of the periodic system and the relation of the activation heat to the scattering of metal atoms are discussed. (R.V.J.)

1535

NUCLEAR IRRADIATION AND RADIOISOTOPES IN METAL RESEARCH. Massoud T. Simnad (General Dynamics Corp., San Diego, Calif.). Intern. J. Appl. Radiation Isotopes 1, 145-71(1956) Nov.

This review covers a wide range of topics in the field of metal research where nuclear irradiation and radioisotopes have been employed. Nuclear irradiation has been used both as a means to detect minute quantities of impurities or minor constituents, and as a powerful tool for carrying out studies of the structure of metals. Radioisotopes have found increasing application in almost all branches of metal research, namely, in studies of segregation, friction, vapor deposition, vapor pressure, slag metal reactions, electrolytic action on metal surfaces, and diffusion and oxidation. (auth)

1536

QUANTITATIVE STUDY OF SUBSTRUCTURE CHARACTERISTICS AND CORRELATION TO TENSILE-PROPERTY OF NICKEL AND NICKEL ALLOY. Sigmund Weissmann (Rutgers Univ., New Brunswick, N. J.). J. Appl. Phys. 27, 1335-44(1956) Nov.

The application of a method combining x-ray microscopy and diffraction analysis to the study of the substructure of nickel and nickel alloys disclosed the coexistence of three orders of magnitude of substructural entities. These three orders are structurally interrelated and distinguished by different ranges of size, disorientation angle, and lattice misalignment. The statistical analysis of the data disclosed that for the two largest orders of substructural entities increasing amounts of room temperature deformation cause (1) a decrease in the mean size and a decrease in the spread of the size distribution, (2) an increase in the mean disorientation angle between substructural entities of the same order and an increase in the spread of the distribution of angles, and (3) an increase in the mean lattice misalignment and spread in the distribution of misalignment. Progressive room temperature deformation causes the low-angle boundaries to become increasingly unsymmetrical and greatly increases the number of the smallest substructural entities. The rise of flow stress as a function of room temperature deformation was correlated to the systematic modification of substructure characteristics. (auth)

1537

16-8-2 Cr–Ni–Mo FOR WELDING ELECTRODE. O. R. Carpenter and R. D. Wylie (Babcock & Wilcox Co., Barberton, Ohio). Metal Progr. 70, No. 5, 65-74(1956) Nov.

The use of C–Mo–Ni alloys for welding electrodes for stainless steel equipment in high-temperature service was found to be free from weld cracks and superior to the usual type 347 electrode in all respects save resistance to intergranular corrosion. (J.E.D.)

1538

MAGNESIUM AND CALCIUM AS METALLURGICAL REDUCING AGENTS. L. M. Pidgeon (Univ. of Toronto, Canada). Metal Progr. 70, No. 5, 75-7(1956) Nov.

The production of reactive metals, Ti, Zr, Th, Be, U, and rare earths, by reduction of their halides or oxides with Mg or Ca is discussed. (J.E.D.)

1539

CREEP OF METALS. Tomoyoshi Kawada, Jumpei Shioiri, and Teruyuki Ueda. Ôyô Butsuri 24, No. 1, 18-27(1956). Jan. (In Japanese)

1540

NEUTRON DIFFRACTION STUDY OF THE STRUCTURES AND MAGNETIC PROPERTIES OF MANGANESE BISMUTHIDE. B. W. Roberts (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 104, 607-16(1956) Nov. 1.

The intermetallic compound, BiMn, has been studied by neutron diffraction at temperatures from 4.2°K to 733°K (460°C). In the temperature range 340 to 360°C to 445°C a disordered arrangement of Mn atoms on regular and interstitial lattice sites fits the data well if the Mn atoms are assumed to be in the paramagnetic state. This model conflicts with the suggestion of an antiferromagnetic state in this temperature range. The temperature hysteresis associated with both magnetization and the large cell distortions are qualitatively explained by the disordering and recovery at the transformation temperatures. The effective moment per Mn atom below the transformation agrees with the magnetic measurements of Heikes within experimental error. Measurements of spin direction made at temperatures below 84°K show that only partial rotation occurs in zero magnetic field. (auth)

Refer also to abstract 1558.

PHYSICS

1541 AECU-3374

Syracuse Univ., N. Y. Research Inst.

DYNAMIC LOADING OF RUPTURE DISCS. Melvin Joseph Leibson. July 31, 1956. 76p. For [Oak Ridge National Lab.]. Contract W-7405-eng-26, Subcontract No. 548. (SURI-Ch.E.-273-567F5). $12.30(ph OTS); $4.50(mf OTS).

The study of the effects of gaseous detonations upon certain materials is reported. Two aspects of the over-all problem of gaseous detonations in reactor vessels and components were investigated. Initially, the theoretical dynamic ultimate yield stress was studied and compared with the static ultimate yield stress of stainless steel-type 304, Ni, phosphor bronze, and cold-rolled steel. Secondly, the effect of work-hardening upon the dynamic ultimate yield stress was determined for these four metals. The metals used were in the form of commercially-produced one in. rupture discs. Each set of discs was rated by the manufacturer, and the ratings were considered as the static ultimate yield stress. The dynamic loading of the discs was produced by the detonation of a stoichiometric mixture of H and O in a shock tube. The discs were placed at the end of the tube perpendicular to the path of the detonation shock wave. The results of this study indicated that the ratio of the theoretical dynamic ultimate yield stress to the rupture disc rating (static ultimate yield stress) was greater than one for all four materials and the relationship between the theoretical dynamic ultimate yield stress and the rupture disc rating was linear with a correlation coefficient of 0.998 for stainless steel-type 304. Of the four materials tested, only phosphor bronze did not dynamically work-harden. (auth)

1542 AECU-3377

Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

ANNUAL PROGRESS REPORT [COVERING] RESEARCHES DURING THE PERIOD JUNE 1, 1955 TO MAY 31, 1956. Report No. 41. 236p. Contracts AT(30-1)-905 and N5ori-07806. $36.30(ph OTS); $10.20(mf OTS).

Investigations are reported in chemistry of fission elements, nuclear chemistry (organic and inorganic), cosmic rays, elementary particle scattering, neutron physics, neutron spectroscopy, radioactivity, particle accelerators, and theoretical physics. (For preceding period see AECU-3253.) (T.R.H.)

1543 AECU-3380

California. Univ., Berkeley. Minerals Research Lab.

FUNDAMENTALS OF GLASS-TO-METAL BONDING. VI. FURTHER EXPLORATORY STUDIES ON THE PRESSURE DEPENDENCE OF THE WETTABILITY OF PLATINUM BY SODIUM SILICATE GLASS. Technical Progress Report No. 6. Milton L. Volpe, Richard M. Fulrath, and Joseph A. Pask. Aug. 1, 1956. 21p. Project No. 7. Contract AT(11-1)-34. $4.80(ph OTS); $2.70(mf OTS).

Attempts were made to obtain specific data showing the change in contact angle with increase of furnace gas pressure. Considerable effort was thus expended toward modifying the vacuum furnace. The first change was a replacement of the W heating elements and Mo radiation shields with Pt. Difficulties, such as mass transfer of Pt and maintaining low O_2 pressures because of an apparent "gettering" action, were encountered. A second major change involved the inclusion of a silica tube into the system for holding the test specimen so that no exposure to metal vapors would occur during the experiments. The movement of the contact angle with change of pressure after an extended period of experimentation became sluggish and reproducibility became a problem. The ex-

ploratory measurements of contact angles with variations in pressures that were obtained in both systems are presented. Variations are discussed. (auth)

1544

MECHANICALLY SEALED BERYLLIUM WINDOWS FOR PERMANENTLY EVACUATED X-RAY TUBES. John T. Perry (Dunlee Corp., Chicago). Rev. Sci. Instr. 27, 759-62 (1956) Sept.

A new type of permanently evacuated x-ray tube with a mechanically sealed low absorption beryllium window has been developed. The construction and low-voltage x-ray output measurements of this tube are presented and discussed. (auth)

ASTROPHYSICS

1545

EARTH SATELLITES AS RESEARCH VEHICLES. PROCEEDINGS OF THE SYMPOSIUM HELD APRIL 18, 1956 AT THE FRANKLIN INSTITUTE IN PHILADELPHIA. Monograph No. 2. Philadelphia, Journal of the Franklin Institute, June 1956. 115p.

Peace-time, constructive, scientific, and beneficial aspects of earth satellites and research vehicles are considered. Discussions are included of the International Geophysical Year earth satellite program, a moon rocket, astronautical and space-medical research with automatic satellites, astrophysical research with an artificial satellite, the effect of the earth's oblateness and atmosphere on a satellite orbit, an artificial celestial navigation system, and recovery of data in physical form. (J.H.M.)

COSMIC RADIATION

1546

ANALYSIS OF AN ELECTRON SHOWER ASSOCIATED WITH A VERY ENERGETIC He NUCLEUS. N. Seeman and R. G. Glasser (Naval Research Lab., Washington, D. C.). Nuovo cimento (10) 4, 703-12(1956) Oct.

An event has been observed which is interpreted as the direct production of an electron pair by a helium nucleus of the cosmic radiation. The primary helium nucleus has a measured energy of $(1.7 \pm 0.5) \times 10^5$ Bev. The pair has an energy of 20 ± 4 Bev and initiates an electron shower. (auth)

1547

HIGH ENERGY NUCLEAR INTERACTIONS IN LEAD BY COSMIC RAY PROTONS AT 3500 m. R. Giacconi, A. Lovati, A. Mura, and C. Succi (Istituto di Scienze Fisiche dell'Universita, Milan). Nuovo cimento (10) 4, 826-33 (1956) Oct.

A multiplate cloud chamber, triggered by G-M counters, has been operated at 3500 meters a.s.l. to collect high energy nuclear interactions in lead by cosmic ray protons. A study is made of the development of the nuclear cascade in lead. The angular distribution of the secondary interacting particles, the characteristics of the successive interactions of the cascade, the mean free path for nuclear interaction of the secondary ionizing particles have been analyzed. For the shower particles produced in high energy interactions (by protons of mean energy 50 Bev) similar to the jets of nuclear emulsions, the mean free path is found to be geometrical. Associated with the 786 interactions seen in the chamber, 15 V^0 and 3 $V^{\pm}$ particles have been observed. The distribution of the angles between the production plane and the decay plane of the V^0 is given. (auth)

1548

A V^0-DECAY WITH AN ELECTRON SECONDARY. C. d' Andlau, R. Armenteros, A. Astier, H. C. DeStaebler, B. P. Gregory, L. Leprince-Ringuet, F. Muller, C. Peyrou, and J. H. Tinlot (Laboratoire de Physique de l'Ecole Polytechnique, Paris). Nuovo cimento (10) 4, 917-21(1956) Oct.

The description and a discussion of an anomalous V^0 decay of particular interest discovered in a survey of photographs taken in the Ecole Polytechnique magnet cloud chamber are given. (auth)

1549

LABORATORY ENERGY DISTRIBUTION OF Λ^0 PARTICLES. G. T. Reynolds (Imperial Coll., London). Nuovo cimento (10) 4, 933-4(1956) Oct.

Several interactions are pointed out which should be considered in evaluating the possible anisotropy of Λ^0 production in complex nuclei. (B.J.H.)

1550

SOLAR COSMIC RAYS OF FEBRUARY 1956 AND THEIR PROPAGATION THROUGH INTERPLANETARY SPACE. J. Meyer, E. N. Parker, and J. A. Simpson (Enrico Fermi Inst. for Nuclear Studies, Chicago). Phys. Rev. 104, 768-83(1956) Nov. 1.

The data from six neutron-intensity monitors distributed over a wide range of geomagnetic latitudes have been used to study the large and temporary increase of cosmic-ray intensity which occurred on February 23, 1956, in association with a solar flare. From these experiments the primary particle intensity spectrum as a function of particle rigidity, over the range <2 to >15–30 Bv rigidity, has been deduced for different times during the period of enhanced intensity. It is shown that the region between the sun and the earth should be free of magnetic fields greater than $\sim 10^{-6}$ gauss and that the incoming radiation was practically isotropic for more than 16 hours following maximum flare particle intensity. The decline of particle intensity as a function of time t depends upon the power law $t^{-\frac{3}{2}}$, except for high-energy particles and late times, where the time dependence approaches an exponential. The experiments lead to a model for the inner solar system which requires a field-free cavity of radius greater than the sun-earth distance enclosed by a continuous barrier region of irregular magnetic fields [B (rms) $\approx 10^{-5}$ gauss] through which the cosmic-ray particles must diffuse to reach interstellar space. This barrier is also invoked to scatter flare particles back into the field-free cavity and to determine the rate of declining intensity observed at the earth. The diffusion mechanism is strongly supported by the fact that the time dependence $t^{-\frac{3}{2}}$ represents a special solution of the diffusion equation under initial and boundary conditions required by experimental evidence. The coefficient of diffusion, the magnitude of the magnetic field regions, the dimensions of the barrier and cavity, and the total kinetic energy of the high-energy solar injected particles have been estimated for this model. Recent studies of interplanetary space indicate that the conditions suggested by the experiments may be established from time to time in the solar system. The extension of the model to the explanation of earlier cosmic-ray flare observations appears to be satisfactory. The solar flare event was superposed by chance upon a large but typical intensity decrease of nonsolar cosmic rays which began several days prior to February 23. Hence, the flare particles have been used as probes to explore the intensity modulation mechanism responsible for this decrease of background cosmic-ray intensity. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1551

INSTRUMENTAL FACTORS IN X-RAY DIFFRACTOMETER. Pekka Rautala and Lassi Hyvärinen. Ann. Acad. Sci. Fennicae Ser. A. I., No. 192, 1955. 14p.

A mathematical analysis is given here for the instrumental factors of a particular instrument consisting of Geiger counter, Soller slits, and a focusing monochromator. (T.R.H.)

1552

PARAMAGNETIC RESONANCE INVESTIGATION OF IR-RADIATED KCl CRYSTALS CONTAINING U-CENTERS. C. J. Delbecq, B. Smaller, and P. H. Yuster (Argonne National Lab., Lemont, Ill.). Phys. Rev. 104, 599-604 (1956) Nov. 1.

The effects of ultraviolet irradiation of KCl–KH and KCl–KD single crystals at 80 and 300°K have been investigated using paramagnetic resonance and optical absorption techniques. KCl–KH crystals irradiated at 80°K have been found to exhibit, along with the usual F-center spin resonance, a resonance doublet with a splitting of 500 ± 10 gauss and a line width of 68 ± 5 gauss; the doublet is presumed to be due to hydrogen atoms in the crystal. This conclusion is substantiated by the fact that KCl–KD crystals, after a similar irradiation, exhibit a resonance triplet with a separation of outer components of 156 ± 10 gauss. Further results lead to the following conclusions: (1) that the hydrogen atoms produced by irradiation are located in interstitial positions in the lattice, (2) that these interstitial hydrogen atoms give rise to an optical absorption band (U_2-band) located at 236 mμ, (3) that a broad optical absorption band (U_1-band) extending to the long wavelength side of the U-band is due to interstitial hydride ions. (auth)

1553

PROPOSED MECHANISM FOR THE CONVERSION OF U-CENTERS TO F-CENTERS BELOW 90°K. C. J. Delbecq and P. H. Yuster (Argonne National Lab., Lemont, Ill.). Phys. Rev. 104, 605-6(1956) Nov. 1.

Experiments with KCl–KH single crystals suggest the following mechanism for the production of F centers from U centers at temperatures below 90°K. The thermal spike, produced after excitation of a U center, is sufficiently energetic to eject the hydride ion into an interstitial position. Excitation of an interstitial hydride ion (U_1 center) may result in the transfer of the excited electron via a tunneling process to a negative-ion vacancy (α center) forming an F center and an interstitial hydrogen atom. Excitation of an F center may reverse the latter process, also via a tunneling process. The tunneling probabilities for these processes vary with the tunneling distance, and experimental results indicate the existence of four distance intervals, about an α center, each interval being characterized by the tunneling processes which can occur. (auth)

ELECTRICAL DISCHARGE

1554 UCRL-4439(Rev.)

California. Univ., Livermore. Radiation Lab.

AN "EXACT" ANALYSIS OF A CYLINDRICAL PLASMA IN A MAGNETIC FIELD. Lewi Tonks. Jan. 14, 1955. Decl. Aug. 16, 1956. 16p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

The analysis of an immobilized plasma is here extended to the case where the geometry is cylindrical rather than Cartesian. (auth)

1555

MICROWAVE STUDIES OF THE ELECTRON LOSS PROCESSES IN GASEOUS DISCHARGES. Romayne F. Whitmer (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 104, 572-5(1956) Nov. 1.

A method for studying electron loss processes in gaseous discharges by means of the free transmission of microwave signals through the discharge is discussed. This method has the advantage that it is easily adaptable to any size or shape of discharge tube. The electron loss processes in pure hydrogen have been studied using this method. For electron densities of 5×10^{13} cm^{-3}, the electron-ion recombination coefficient has been found to be approximately 5.9×10^{-11} cm^{-3} sec^{-1}. An electron-neutral collision frequency of 3.97×10^{9} sec^{-1} at a pressure of 0.29 mm Hg has been measured. The dominant loss process proved to be attachment, with a probability of attachment of approximately 3×10^{-6}. (auth)

ELECTRONS

1556

MOTION OF ELECTRONS IN CYCLIC ACCELERATORS AS A STOCHASTIC PROCESS. A. N. Matveev (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 109, 495-8(1956) July 21. (In Russian)

1557

BREMSSTRAHLUNG POLARIZATION MEASUREMENTS FOR 1.0-MEV ELECTRONS. J. W. Motz (National Bureau of Standards, Washington, D. C.). Phys. Rev. 104, 557-62 (1956) Nov. 1.

With 1-Mev electrons incident on thin Al and Au targets, bremsstrahlung polarization as a function of photon energy for a 20-degree emission angle has been measured with a polarimeter that depends on the polarization sensitivity of the Compton process. The selection of energy intervals out of the continuous bremsstrahlung spectrum was accomplished by employing the polarimeter as a double crystal Compton spectrometer. The results show a polarization reversal in qualitative agreement with the Born approximation calculations of Gluckstern and Hull. With the Au target, the polarization reversal occurs at a lower photon energy than that predicted by the Born approximation theory. Such a shift in the reversal energy is obtained with the Born approximation theory for a lower initial electron energy. (auth)

INSTRUMENTS

1558 HW-44720

Hanford Atomic Products Operation, Richland, Wash.

NICKEL DEPTH METER. G. D. Linsey. July 31, 1956. 18p. Contract W-31-109-Eng-52. $0.20(OTS).

An electronic instrument based on eddy current principles has been developed for measuring the thickness of thin layers of Ni plated onto a non-magnetic base metal. Circuits are given and discussed for a particular model which can measure Ni thickness over a range of 0.1 to 2.0 mils with an accuracy of within about 5%. (auth)

1559 NARF-56-30T

Convair, Fort Worth, Tex.

MULTICHANNEL GAMMA DETECTION SYSTEM FOR THE NTA. C. M. Travis and B. M. Lasater. Sept. 4, 1956. 38p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-111).

A small, compact, multiple-location, airborne system for monitoring γ radiation was devised. The Glass electrometer, a bridge type vacuum tube, was used as a basic circuit for the system. Zero drift is cancelled out by the opposing drift of the matched tube. (F.S.)

1560 AEC-tr-2526

A CAPACTIVE VOLTAGE DIVIDER FOR THE MEASUREMENT OF PULSE VOLTAGES UP TO 2000 KV. P. G. Provoost. Translated from Electro-techniek 29, 281-4(1951). 7p.

A capacitance voltage divider for the measurement of pulse voltages up to 2000 kv is described. An analysis is included of the behavior of the voltage divider and connecting cable with respect to pulse voltage. (J.H.M.)

1561
ARGONNE 256-CHANNEL PULSE-HEIGHT ANALYZER. Robert W. Schumann and James P. McMahon (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 27, 675-85 (1956) Sept.

A 256-channel pulse-height analyzer using a magnetic core memory is now in use at the Argonne National Laboratory. This analyzer uses a form of the Wilkinson method of generating numbers in response to input pulses. These numbers are proportional to the amplitudes of the input pulses, and correspond to the channel numbers into which the individual counts are to be recorded. The digital data processing circuits comprise a simple computer, with an internal memory which can store 256 sixteen digit binary numbers. A cathode-ray tube display of the data in the form of a plot of counts versus channel number is available during and after operation. Permanent readout is in the form of a similar curve traced by a recording potentiometer. Printed decimal readout is also available. The normal average analyzer dead time is 80 μsec, and pulse rates in excess of 5 million per min at the input circuit can be tolerated without appreciable data distortion. (auth)

1562
RECORDING: PHOTOMETRIC PARTICLE-SIZE ANALYZER. N. A. Talvitie and H. J. Paulus (U. S. Dept. of Health, Education, and Welfare, Cincinnati, Ohio). Rev. Sci. Instr. 27, 763-7(1956) Sept.

A recording, photometric particle-size analyzer has been developed which is useful in comparing the particle-size distributions of dusts in the subsieve range. The instrument follows the progress of the sedimentation of a suspension by means of a collimated beam. Provision for continuously varying the sedimentation depth allows analysis of the entire range within 1 hr. The optical system and temperature control were designed to increase the accuracy of analysis of the finer particles. A simplified system is given for calibrating the sedimentation curves in terms of particle size. (auth)

1563
HIGH TEMPERATURE X-RAY DIFFRACTION CAMERA. A. E. Austin, N. A. Richard, and C. M. Schwartz (Battelle Memorial Inst., Columbus, Ohio). Rev. Sci. Instr. 27, 860-2(1956) Oct.

A high-temperature x-ray powder diffraction camera has been designed and constructed. The design specifications were as follows: (1) to permit operation at temperatures up to at least 2000°C, in a high vacuum, (2) to be able to work in controlled atmosphere at somewhat lower temperatures, and (3) to permit successive exposures of the specimen held at temperature. The completed apparatus appears to meet these requirements. (auth)

1564
ANALYSIS OF D_2O/H_2O BY THE INTERFEROMETER. Susumu Namba (Scientific Research Inst., Ltd., Tokyo). Rev. Sci. Instr. 27, 872-3(1956) Oct.

A description is given of an interferometer for the analysis of the ratio of D_2O to H_2O. (J.H.M.)

1565
OPTICAL SYSTEM TO SIMPLIFY ANALYSIS OF BUBBLE CHAMBER PHOTOGRAPHS. N. P. Campbell and I. A. Pless (Enrico Fermi Inst. for Nuclear Studies, Chicago). Rev. Sci. Instr. 27, 875(1956) Oct.

The use of a correcting lens to simplify the analysis of bubble chamber photographs is discussed. The optical system is described, and the placing of the lens to make the projection orthographic is included. (J.H.M.)

1566
GOUY MODULATOR FOR THERMOCOUPLES. William Primak (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 27, 877(1956) Oct.

A device for reducing fluctuations in the temperature of furnaces controlled by thermocouple regulators is described. (J.H.M.)

ISOTOPES

1567
HALF-LIVES OF COBALT-60, THALLIUM-204, AND EUROPIUM-152. E. E. Lockett and R. H. Thomas (Atomic Energy Research Establishment, Harwell, Berks, England). Nucleonics 14, No. 11, 127(1956) Nov.

The half lives of Co^{60}, Tl^{204}, and Eu^{152} are 5.20 ± 0.03 yr., 4.5 yr ± 10% and 1.6 yr. ± 15% (2 periods), and 12.7 ± 0.2 yr. respectively. Previous data are superseded by these figures. (T.R.H.)

ISOTOPE SEPARATION

1568
EXCHANGE OF DEUTERIUM AND ^{18}O BETWEEN WATER AND OTHER SUBSTANCES. 2. ALTERNATIVE METHODS. I. M. Krause and K. Linderstrøm-Lang. 3. DEUTERIUM EXCHANGE OF SHORT PEPTIDES, SANGER'S A-CHAIN AND INSULIN. Aase Hvidt and K. Linderstrøm-Lang. Compt. rend. trav. lab. Carlsberg Ser. chim. 29, No. 22-23, 367-402(1955). (In English)

A method and device are described which are useful in kinetic studies of isotopic exchange reactions involving H_2 and O^{18}. The method, which employs cryosublimation, is applied to the study of hydrogen bonding in proteins. (T.R.H.)

1569
ELECTROMAGNETICALLY ENRICHED ISOTOPES AND MASS SPECTROMETRY. PROCEEDINGS OF THE CONFERENCE HELD IN THE COCKCROFT HALL, HARWELL, 13-16 SEPTEMBER 1955. M. L. Smith, ed. London, Butterworths Scientific Publications, 1956. 272p.

A summary is given of developments and future work in the field of electromagnetic isotope separation. The topics covered are ion sources, collector problems, chemical aspects and target preparation, utilization, isotopic abundance analysis, design of electromagnetic separators, and separation of active materials. (T.R.H.)

MASS SPECTROGRAPHY

1570 IGR-R/CA-180
Gt. Brit. Capenhurst Works, Capenhurst, Ches., England. A SPECIAL MASS SPECTROMETER FOR THE ISOTOPIC ANALYSIS OF LITHIUM. P. G. Bentley, J. Bishop, and D. Davidson. July 13, 1956. 38p.

A special mass spectrometer for the isotopic analysis of Li has been designed, built and tested. An ion source of the surface ionization type provides ions from solid Li nitrate. The mass spectrometer tube is made in the shape of a "Y" with three arms at 120° to one another, in which two of the arms take ion sources and the third takes a collector; either source and the collector form a 60° mass spectrometer, depending on the direction of the magnetic field at the centre of the "Y". With this system, one ion source can be decontaminating (checking a clean source for residual ion beams) while measurements of isotope ratio are being made on the other source. A gate valve is fitted in each source arm of the spectrometer tube, so that sources can be changed without having to let up the entire vacuum system to atmospheric pressure. Measurements of the isotope ratio are made semi-automatically. The mass spectrum is scanned by varying the magnetic field; as each lithium ion beam comes on to the collector, the voltage output of the vibrating-reed amplifier is remem-

bered by a capacitor. The voltage amplification of one ion beam is adjusted until the two remembered voltages are equal; the isotope ratio is then read directly from a calibrated dial. (auth)

1571

ACCURATE MATHEMATICAL TREATMENT OF THE ANALYZER OF THE RF MASS SPECTROMETER TUBE. W. W. Cannon and M. K. Testerman (Univ. of Arkansas, Fayetteville). J. Appl. Phys. 27, 1283-6(1956) Nov.

A mathematical treatment of the Bennett-type rf mass spectrometer has been developed which is appreciably simpler to handle when dealing with a multistage analyzer. This simplification is a result of changing the point of reference in the tube from that previously used. The resulting form of the equation is soluble by the use of a very simple analog computer which is described. (auth)

1572

INFLUENCE OF MAGNETIC AND ELECTRIC FIELD DISTRIBUTION ON THE OPERATION OF THE OMEGATRON. Wilson M. Brubaker and George D. Perkins (Consolidated Electrodynamics Corp., Pasadena, Calif.). Rev. Sci. Instr. 27, 720-5(1956) Sept.

The operation of an omegatron is discussed with polyphase electric excitation. Use is then made of this analysis to investigate the ionic trajectories in an omegatron in which the natural frequency of the ion is a function of the orbital radius. This circumstance comes about from either the influence of space charge or from the use of a magnetic field which decreases with increasing radius. The nonuniform magnetic field and the radial electric field can enhance the resolving power. It also influences the peak shape, causing the sides to be nearly vertical. Trapping of the ions is essential for satisfactory operation of the omegatron. Two experimentally proven means of accomplishing trapping are presented. (auth)

1573

THERMAL TRANSPIRATION IN THE MASS SPECTROMETER INLET SYSTEM. Leonard A. Dietz (General Electric Co., Schenectady, N. Y.). Rev. Sci. Instr. 27, 817-18 (1956) Oct.

Transpiration of gas in the inlet tube between the sample reservoir and the ion source is eliminated if the thermal gradient occurs in the low-pressure region between the leak and the ion source. Since transpiration was found to be a total pressure effect, sensitivity response is not affected if gas mixtures and calibrating gases are run at the same pressure, even though transpiration is present. (auth)

1574

IMAGE CURVATURE CAUSED BY FRINGING FIELDS IN MAGNETIC SECTOR MASS SPECTROMETERS. Clifford E. Berry (Consolidated Electrodynamics Corp., Pasadena, Calif.). Rev. Sci. Instr. 27, 849-53(1956) Oct.

The fringing field of a magnetic sector analyzer produces a curved image of a line object. This is because rays off the median plane traverse a slightly different fringing field from that traversed by those on the median plane. In this paper, the shape of the image is calculated for a general paraxial ray traveling in a plane inclined to the median plane, under the assumption that the fringing field is two-dimensional. It is found that the image is not only curved, but is broadened by an amount depending on the exact nature of the fringing field. In the special case in which all paraxial rays travel in planes parallel to the median plane, and in which the analyzer is symmetrical, a straight-line object is imaged in a line having a radius of curvature of R/2, where R is the sector radius. In this special case, the shape of the image is independent of the exact nature of the fringing field. (auth)

MATHEMATICS

1575 WAPD-TM-3

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

A FEW GROUP ONE-DIMENSIONAL CODE FOR IBM-650. Henry Bohl, Jr., Ely Gelbard, and Roland Suarez. July 1956. 38p. Contract AT-11-1-GEN-14. $0.30(OTS).

The Lil Abner one-to-eight group code for the IBM-650 to treat one-dimensional reactor and cell problems is discussed, and a mathematical analysis of the code is included. (J.H.M.)

1576 AEC-tr-2687

ON THE PRESERVATION OF ASYMPTOTIC STABILITY IN TRANSITION FROM DIFFERENTIAL EQUATIONS TO THE CORRESPONDING DIFFERENCE EQUATIONS. M. A. Skalkina. Translated by V. Beak from Doklady Akad. Nauk S.S.S.R. 104, 505-8(1955). 6p.

1577 AEC-tr-2688

SOME REMARKS ON THE PROBLEM OF THE NUMERICAL INTEGRATION OF DIFFERENTIAL EQUATIONS BY FINITE DIFFERENCE METHODS. M. V. Lomonosov. June 30, 1955. Translated by M. C. Wheeler from Doklady Akad. Nauk S.S.S.R. 104, 805-9(1955). 5p.

1578

A SOLUTION OF THE DIFFUSION EQUATION FOR ISOTOPIC EXCHANGE BETWEEN A SEMI-INFINITE SOLID AND A WELL STIRRED SOLUTION. I. R. Beattie (King's Coll., London) and D. R. Davies (The Univ., Sheffield). Phil. Mag. (8) 1, 874-9(1956) Sept.

A theoretical solution of the problem of diffusion of material from a semi-infinite solid of known surface area into a given volume of a well-stirred liquid is derived. The equations developed are based on the assumption that Fick's Law may be applied to the system under consideration. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

1579 ANL-5622

Argonne National Lab., Lemont, Ill.

INTERPRETATION OF COUNTING DATA. Ellis P. Steinberg. Sept. 26, 1956. 66p. Contract W-31-109-eng-38. $0.45(OTS).

Factors affecting the accuracy of counting data are reviewed. General considerations are discussed, and the interpretation of counting data for β, α, and γ counting are discussed in detail. Formulas for geometric calculations and resolution loss corrections in counting are appended. (156 references.) (C.H.)

1580 LA-2069

Los Alamos Scientific Lab., N. Mex.

SOME CHARACTERISTICS OF PLASTIC FLUOR. M. M. Hoffman, R. W. Peterson, and M. Janco. Sept. 1956. 16p. Contract W-7405-Eng-36. $0.20(OTS).

The emission spectrum, transmission of visible and ultra-violet light, refractive index, temperature coefficient of efficiency, and pulse height as a function of proton and deuteron energy have been measured for a plastic flour. The emission spectrum was found to have a broad peak extending from about 4000A to 4250A. The transmission was measured from 3000A to 8000A and was found to be quite high in the region above 4000A, but to decrease abruptly by a factor of more than 1000 just below 4000A. The refractive index was measured between 4000A and 6850A and was found to increase with decreasing wave length. The temperature coefficient of efficiency was measured between −5°C and +100°C and was found to decrease with increasing temperature. The relative pulse height from the fluor is given for proton and deuteron energies from 0.75 to 4.5 Mev. (auth)

1581 OSR-TR-56-32

New York Univ., New York. Coll. of Engineering. NEGATIVE ION EFFECTS IN HALOGEN QUENCHED GEIGER COUNTERS. Harold Sherman. Aug. 8, 1956. 91p. Geiger Counter Project. Contract AF18(600)-1460. (AD-95807).

Using pulsed x rays as a source of ionization, measurements of time lags were made in Geiger counters filled with the following gases: neon and chlorine; neon, argon, and chlorine; argon and iodine; and krypton and iodine. The values of time lags observed range from 13 to 0.3 microseconds depending upon the concentration of halogen gas in the counter and the overvoltage. It is shown that the delays cannot be due to negative ions, but are probably caused by the relatively long time that it takes for the halogen molecules to de-excite the noble gas metastables formed in the avalanche. Assuming that negative ions are formed in the counters, Shinohara and Akutsu have given a quantitative description of the variation in counter efficiency as a function of the radical distance of the ionizing event from the central wire. Using a collimated beam of x rays to excite the counter, the above theory has been tested, and good agreement of theory and experiment has been found. In particular, it has been shown that the formation of negative ions may sharply reduce the efficiency of a counter near the cathode. An extension of the above theory indicates that another effect of negative ions is to increase the plateau slopes of these counters. Detailed observations of plateau slopes support this conclusion. (auth)

1582 WAPD-TM-13

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. ANALYSIS OF PULSE PILE-UP EFFECTS IN A PULSE-COUNTING SYSTEM. R. H. Frazier. Sept. 1956. 88p. Contract AT-11-1-GEN-14. $13.80(ph OTS); $4.80(mc OTS).

Problems related to the counting of pulses due to radiation in the presence of smaller pulses due to background radiation are analyzed. Factors affecting pulse pile-up in the pulse counting system are reviewed. The pulse-counting system under study consists essentially of a chamber in which ionization is created either directly or indirectly by the radiation to be measured, an amplifier that enlarges the pulses generated by ionization in the chamber, a discriminator that recognizes only those enlarged pulses that exceed a predetermined voltage level and is triggered by those pulses to deliver still larger and essentially uniform rectangular pulses to a scaler and register or other counting device. A simple block diagram of the apparatus is included. Operating data are presented graphically and in tabular form. Derivations and methods used in the computations are appended. (C.H.)

1583

REDUCTION OF COUNTING TIME IN LOW ACTIVITY ASSAYS. H. A. Hughes (Western General Hospital, Edinburgh, Scotland). Brit. J. Appl. Phys. 7, 415-16(1956) Nov.

Modification of a counting system can result in a reduction in background and sample counting rates. Such an arrangement will decrease the minimum counting time necessary to achieve a given fractional deviation in the net counting rate only under certain conditions. A method is described of determining these conditions. The application of this principle is exemplified in the use of a pulse amplitude analyser with a scintillation counter. (auth)

1584

RADIOGRAPH–UNIVERSAL NON-LINEAR INTEGRATOR FOR IN VIVO INVESTIGATIONS BY MEANS OF RADIOACTIVE ISOTOPES. G. M. Frank, N. A. Gabelova, V. V. Markelov, and E. T. Martusov. Bull. Exptl. Biol. Med. (U.S.S.R.) 41, 85-9(1956) Jan. (In English)

Design is described of a radiation detection instrument for use in in vivo tracer studies. The instrument, which is called a universal nonlinear integrating radiograph, consists of two independently operating instruments, which together with feed block and ink writing apparatus are mounted in the general casing. Two massive arms, the upper portions of which possess 6 degrees of freedom, are mounted on the upper part of the casing. A luminescent counter, consisting of a photomultiplier and a luminescent crystal, is attached to the end of each arm. The crystal of each counter is encircled by a cylindrical lead shield to reduce the sensitivity of the counter to γ radiation directed at a large angle to the axis of the photomultiplier crystal. (C.H.)

1585

THE APPLICATIONS OF STANDARDS OF RADIOACTIVITY. H. H. Seliger (National Bureau of Standards, Washington, D. C.). Intern. J. Appl. Radiation Isotopes 1, 215-32(1956) Nov.

The application of standards of radioactivity for determination of absolute efficiencies of detectors, determination of long half-lives, and determination of mean energies are reviewed. Most of the available isotopes are listed and methods of routine assay are suggested. The various types of detectors used for routine radioactivity assay in the laboratory are discussed and their efficiencies are evaluated. Techniques are suggested for the preparation of laboratory standards from the standards issued by the National Bureau of Standards. The use of simulated standards in both beta- and gamma-ray measurements is described. (54 references) (auth)

1586

EFFICIENCY OF 4π-CRYSTAL-SCINTILLATION COUNTING. 1. EXPERIMENTAL TECHNIQUE AND RESULTS. C. C. Smith, H. H. Seliger, and J. Steyn. J. Research Natl. Bur. Standards 57, 251-5(1956) Nov.

The technique of 4π-crystal-scintillation counting has been applied to the standardization of beta-emitting nuclides. Phototubes viewing an anthracene sandwiched source at 180° have been used with high-gain nonoverloading amplifiers in addition and in coincidence circuits to obtain high detection efficiencies. A precise shorted delay-line coincidence analyzer is described. The results of measurements made with P^{32}, Co^{60}, $Sr^{90}-Y^{90}$, I^{131}, and Ti^{204} are compared with those obtained by 4$\pi\beta$-gas-proportional counting. (auth)

1587

EFFICIENCY OF 4π-CRYSTAL-SCINTILLATION COUNTING. 2. DEAD-TIME AND COINCIDENCE CORRECTIONS. W. B. Mann and H. H. Seliger. J. Research Natl. Bur. Standards 57, 257-64(1956) Nov.

The dead-time and coincidence corrections to be applied in 4π-crystal-scintillation counting have been both approximately and rigorously derived. It has been shown that under special conditions the non-randomness due to "true" counts appearing in both channels requires additional correction terms. (auth)

1588

ON THE FILM BADGE ANALYSER OF POLAROID TYPE. Kikuo Takahashi, Katsumi Kuroki, and Miyuki Takahashi (Univ. of Tokyo). Ōyō Butsuri 24, No. 6, 226-33(1955) June. (In Japanese)

Design is described of a convenient film badge analyzer based on a polarization photometer using a half-shadow method and giving direct dose reading in mr units. (C.H.)

1589

DESIGNING SENSITIVE PLASTIC WELL COUNTERS FOR BETA RAYS. W. S. Michel, G. L. Brownell, and J. Mealey,

Jr. (Massachusetts General Hospital, Boston). Nucleonics 14, No. 11, 96-100(1956) Nov.

The effects of wall thickness, absorbers, discriminator level, and sample preparation on detection efficiency and energy discrimination of plastic well counters for β rays are described. (T.R.H.)

1590

A CsI(Tl)-CRYSTAL SURGICAL SCINTILLATION PROBE. C. C. Harris, R. R. Bigelow, J. E. Francis, G. G. Kelley, and P. R. Bell (Oak Ridge National Lab., Tenn.). Nucleonics 14, 102 & 104-8(1956) Nov.

A scintillation counter probe for use during surgery is described. It is both β- and γ-sensitive and possesses several advantages over other instruments. Its usefulness is demonstrated by a case history from ORINS Medical Hospital. (T.R.H.)

1591

COUNTING LOSSES IN I^-, I_2 ON PAINT AND METAL SURFACES. L. H. Gevantman and J. F. Pestaner (Naval Radiological Defense Lab., San Francisco). Nucleonics 14, No. 11, 109-11(1956) Nov.

The losses incurred when neutral I^- solutions containing bisulfite are deposited, dried, and counted on metal, paint, and plastic surfaces are measured and compared with results from similar experiments using elemental I_2. The results indicate that where radioiodine is to be counted in iodide form, the use of brass planchets is advisable. (T.R.H.)

1592

DETERMINATION OF Sr^{90} ACTIVITY IN WATER BY ION-EXCHANGE CONCENTRATION. Charles W. Stanley and Paul Kruger (Nuclear Science and Engineering Corp., Pittsburgh). Nucleonics 14, No. 11, 114 & 116-18(1956) Nov.

1593

ANALYSIS OF THE SCINTISCANNING PROBLEM. J. A. W. van der Does de Bye (Philips Research Labs., Eindhoven, Netherlands). Nucleonics 14, 128 & 130-4(1956) Nov.

Considerations involved in designing collimators and scanning procedures for study of body distribution of gamma emitters are given. (T.R.H.)

1594

Ag-PHOSPHATE GLASS NEEDLES FOR MEASURING GAMMA DOSE. A. L. Riegert, H. E. Johns, and J. W. T. Spinks (Univ. of Saskatchewan, Saskatoon, Canada). Nucleonics 14, No. 11, 134-7(1956) Nov.

Isodose distributions in a Co^{60} γ-ray beam may be mapped using Ag-activated phosphate glass needles. They are better than small ionization chambers for detecting dosages in acid media, and animal and vegetable material undergoing irradiation. (T.R.H.)

1595

A COINCIDENCE ARRANGEMENT FOR THE DETECTION OF LOW ENERGY QUANTA. A. Bisi and L. Zappa (Istituto di Fisica Sperimentale del Politecnico, Milan) and E. Germangnoli (Laboratori CISE, Milan). Nuovo cimento (10) 4, 764-7(1956) Oct.

An experimental arrangement, in which a proportional counter and a scintillation γ ray spectrometer are used in coincidence, is found to be useful in investigations concerning the decay of low energy γ- or x-rays emitters. Some results which have been obtained with the described method are given. (auth)

1596

STUDY OF THE DISSOLUTION OF SILVER GRAINS IN THICK NUCLEAR PLATES IN THE FIXER. G. Thuro and M. Paić (Institut Ruder Bošković et Institut de Physique de la Faculté des Sciences, Zagreb, Yugoslavia). Nuovo cimento (10) 4, 887-97(1956) Oct. (In French)

As a result of a large number of experiments, it was established that the atmospheric oxygen considerably facilitates the dissolution of silver grains in the fixer. For this reason, the dissolution of silver grains of photographic plates in solutions of sodium hyposulfite containing reducing agents, either sodium bisulfite or sodium sulfite in the presence of acetic acid, was studied. Under conditions of diminishing, by prolonged boiling of the H_2O, the quantity of O in the solutions, it is possible to prevent dissolution of the Ag by weak concentrations of these additions. These results have been applied to the fixing of 400 to 600 μm nuclear plates. Regions of concentration of sodium bisulfite or of sodium sulfite in the presence of acetic acid, for which there is no dissolution of the silver or troublesome turbidity of the nuclear plates, have been determined. (tr-auth)

1597

1024-CHANNEL NEUTRON TIME-OF-FLIGHT ANALYZER. Robert W. Schumann (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 27, 686-90(1956) Sept.

A 1024-channel time-of-flight analyzer for recording data obtained in neutron time-of-flight experiments has been placed in operation at the Argonne National Laboratory. Channel widths are adjustable from $\frac{1}{8}$ μsec to essentially any higher value. The analyzer dead time is 16 μsec following each recorded count. The storage circuits may be divided into two sections for recording events detected by two separate counters. The analyzer may also be divided into four groups of 256 channels each. These groups may be independently located in any time region up to 4096 × T, where T is the channel width in use. Readout is by means of simultaneous teletype punched tape and analog pen recording. There is a linear cathode ray tube display of counts vs channel number. The device uses a magnetic core memory system similar to that used in the 256 channel pulse height analyzer described in the preceding article. (auth)

1598

FARADAY-CUP MONITORS FOR HIGH-ENERGY ELECTRON BEAMS. K. L. Brown and G. W. Tautfest (Stanford Univ., Calif.). Rev. Sci. Instr. 27, 696-702(1956) Sept.

Two Faraday-cup electron collectors have been developed which are capable of measuring the absolute integrated beam current of the Stanford linear accelerators to better than 0.5% at electron energies ranging from 4 to 300 Mev. A description of these instruments is given and complete design criteria are offered which allow the extension of the range to Bev energies. (auth)

1599

CONVERSION OF QUANTUM COUNTING RATE TO ROENTGENS. T. R. Kohler and William Parrish (Philips Labs., Irvington-on-Hudson, N. Y.). Rev. Sci. Instr. 27, 705-6 (1956) Sept.

Expressions are derived relating counting rate measured with quantum detectors to the dosage rate in roentgens. The number of quanta/cm^2 per roentgen is strongly energy dependent. In the x-ray region 5 to 50 kv, however, the variation of the quantum counting efficiency with wavelength of some counters (e.g., argon Geiger counter) matches fairly closely the energy dependence factor, and hence such detectors can be used as r-meters. (auth)

1600

IMPROVED TECHNIQUE FOR THE DETERMINATION OF THE C^{12} (γ,n) THRESHOLD AS A BETATRON ENERGY CALIBRATION. Leslie Cohen and John McElhinney (Naval Research Lab., Washington, D. C.). Rev. Sci. Instr. 27, 773(1956) Sept.

A technique that gives a quicker and more accurate determination of the $C^{12}(\gamma,n)$ threshold is discussed. (J.H.M.)

1601

USE OF COUNTER TUBES IN X-RAY ANALYSIS. W. Parrish and T. R. Kohler (Philips Labs., Irvington-on-

Hudson, N. Y.). Rev. Sci. Instr. 27, 795-808(1956) Oct.

The more important properties of end-window Geiger counters, side-window proportional counters, and NaI(Tl) scintillation counters are reviewed and their performance in the 5 to 50 kvp x-ray analysis region is compared. Proportional and scintillation counters have resolving times of the order of 0.25μsec and virtually eliminate the nonlinearity limitation of the Geiger counter. They produce pulse amplitudes proportional to the energy of the x-ray quanta, and thus simple pulse height discrimination techniques can be used to obtain greatly improved peak-to-background ratios with little loss of intensity of the characteristic x rays. They are as reliable and nearly as easy to use as Geiger counters. The electronic discrimination method is described and explained with some practical applications. For a given experimental arrangement, the measured intensity is determined by the quantum counting efficiency of the counter tube, and the peak-to-background ratio is determined by the spectral response of the detector-discriminator combination. (auth)

1602

"TWIN" SCINTILLATION FAST NEUTRON DETECTOR. I. B. Berlman and L. D. Marinelli (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 27, 858-9(1956) Oct.

Two organic scintillating solutions, containing the same total number of electrons, but differing by more than a fourfold in the total number of hydrogen atoms, are used to detect neutrons in the presence of a gamma-ray background. By suitable adjustments of their luminscence their pulse-height spectra can be made to coincide in the presence of gamma radiation; hence by subtracting the spectrum of one solution from that of the other it is possible to obtain the pulse-height spectrum due to the excess of proton recoils in the latter. Although refinements in the interpretation of its response must wait for basic information, on the luminescent efficiency of both protons and electrons of various energy, this detector is simple to build, stable in time, isotropic in response, and suitable to evaluate radiation hazards in the presence of mixed radiations. Typical responses to gamma radiation, D-D, and D-T neutrons are presented. (auth)

1603

DUAL PROPORTIONAL COUNTER FOR LOW-LEVEL MEASUREMENT OF ALPHA ACTIVITY OF BIOLOGICAL MATERIALS. E. W. McDaniel (Georgie Inst. of Tech., Atlanta) and H. J. Schaefer and J. K. Colehour (U. S. Naval School of Aviation Medicine, Pensacola, Fla.). Rev. Sci. Instr. 27, 864-8(1956) Oct.

A device has been developed for the alpha counting of solid materials of extremely low activity. It utilizes two identical detectors of novel design inside a common gas envelope and a programming mechanism to permit the automatic alternation of samples between the counters. The detectors are rectangular, screen wall, proportional counters which operate at an average background of 3.8 counts per hour. Thin, flat samples of 141 cm^2 area may be accommodated. (auth)

1604

CLOUD CHAMBER TRACK MEASURING INSTRUMENT. Philip C. Fisher (Univ. of Illinois, Urbana). Rev. Sci. Instr. 27, 873-4(1956) Oct.

1605

POTTING OF PHOTOMULTIPLIERS FOR USE WITH LIQUID SCINTILLATION DETECTORS. George E. Thomas, JR. (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 27, 878(1956) Oct.

1606

THE CONCEPTION OF THE TISSUE EQUIVALENT AND A SINGLE WATER-LIKE PHANTOM SUBSTANCE FOR ENERGIES OF 10 KEV TO 100 MEV FOR FAST ELECTRONS. Benno Markus. Strahlentherapie 101, 111-31(1956) Sept. (In German)

The author discusses the notion of tissue equivalence (equivalence of materials) of phantom materials, and indicates criteria of greater approximation for water equivalence towards roentgen and gamma-rays and towards high-speed electrons. For some phantom materials used in various places the criteria for energies of 10 Kev to 100 Mev are calculated. The importance of the effective atomic numbers and the limits of their applicability as concerns the characterization of phantom materials are quantitatively discussed. A universal phantom material especially developed for quanta rays and highspeed electrons is indicated. (auth)

1607

RELATIVE DEEP TISSUE DOSES IN INHOMOGENEOUS MEDIA. Günter Balz and Rudolf Birkner. Strahlentherapie 101, 132-7(1956) Sept. (In German)

The authors report on depth dose measurements carried out with different ray qualities in a water phantom, in which layers of idealized tissues and dead bones had been hanged in. Calculation of the relative tissue doses in rad per r surface dose. (auth)

1608

PROBLEMS OF NEUTRON DOSIMETRY. Karl G. Zimmer. Strahlentherapie 101, 143-51(1956) Sept. (In German)

The main problems of dosimetry of fast and thermal neutrons in radiobiological experimentation and in health-physics work are discussed. The need for dosimetric methods in the energy-range between fast and thermal neutrons is emphasized. (auth)

Refer to abstract 1475.

MESONS

1609 OSR-TN-56-533

Stanford Univ., Calif.

PION PRODUCTION IN ELECTRON-PROTON COLLISIONS. Technical Report No. 18. R. H. Dalitz and D. R. Yennie. Nov. 1956. 59p. Project R-357-40-3. Contract AF18(600)-545.

The close relationship between photo-pion and electro-pion production from protons allows an unambiguous first estimate (the standard value) for the ratio of these cross sections, based on assumptions very close to those of the Weizsäcker-Williams method. Deviations of the ratio from this estimate arise from pion production by the longitudinal components of the field of the scattered electron and from the variation of the off-diagonal transverse excitations from their on-diagonal photoproduction values. The dependence of these deviations on the physical processes contributing to the electromagnetic excitation of pions is discussed in terms of matrix elements specified in the pion-nucleon c.m. system, both for various phenomenological contributions and for specific meson theories. The experimental values reported are interpreted as an indication of the smallness of longitudinal production, in qualitative accord with the fixed source theory. These features may also be investigated by study of the energy spectrum of inelastically scattered electrons and of the azimuthal variation of pion production relative to the scattering plane, which are also discussed here. (auth)

1610 UCRL-3507

California. Univ., Berkeley. Radiation Lab.

A MASS DETERMINATION OF THE τ^- MESON. Bernard Waldman. Aug. 29, 1956. 6p. Contract W-7405-eng-48. $0.15(OTS).

Four τ^- meson decays in flight were observed in a 10-

in. liquid hydrogen bubble chamber. The mass of the π^- meson as determined by a kinematical analysis of the events is $963 \pm 10\ m_e$. (auth)

1611 UCRL-3514
California. Univ., Berkeley. Radiation Lab.
IDENTIFICATION CURVES FOR HEAVY-MESON AND HYPERON DECAYS. Howard S. White. Sept. 19, 1956. 26p. Contract W-7405-eng-48. $0.25(OTS).

Curves are presented for the purpose of facilitating identification of heavy-meson and hyperon decays. (auth)

1612
ON THE ANOMALOUS MAGNETIC MOMENT OF μ-MESONS. S. Hirokawa, H. Komori, and S. Ogawa (Nagoya Univ., Japan and Hiroshima Univ., Japan). Nuovo cimento (10) 4, 736-46 (1956) Oct. (cf. NSA 10-5865)

From the analysis of the cosmic ray bursts produced by μ mesons, the upper limit of the magnitude of the anomalous magnetic moment of μ mesons is estimated. As a result, the anomalous magnetic moment of μ mesons is found to be smaller than 80% of the normal Dirac moment. (auth)

1613
INTERACTION AND DECAY OF K^+ MESONS IN FLIGHT. C. Marchi, E. Pedretti, and S. Stantic (Istituto di Fisica dell'Universita, Bologna). Nuovo cimento (10) 4, 940-3 (1956) Oct.

A stack of 24 G5 stripped emulsions was exposed to the beam of positive particles of the Berkeley Bevatron, and observations were made on tracks due to K mesons. The results show no contradiction with Gell-Mann's theory. It was also noticed that the mean free path for inelastic events is energy independent and that charge exchanges are found in the high-energy region. (B.J.H.)

1614
MESON PRODUCTION IN DEUTERIUM BY 1.4-BEV PIONS. V. P. Kenney (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 104, 784-94(1956) Nov. 1.

Pion-nucleon interactions have been produced in a deuterium-filled diffusion cloud chamber operated in the 1.37-Bev π^- beam at the Cosmotron in order to compare the characteristics of $\pi^- - n$ and $\pi^- - p$ collisions. A total of 180 interactions have been observed and analyzed, and the total cross section for $\pi^- - d$ collisions is estimated to be 72 ± 15 millibarns. The results are consistent with approximately equal $\pi^- - p$ and $\pi^- - n$ cross sections and a ratio of elastic: inelastic events = 1:2 for both types of interaction. Approximately 15% of the inelastic collisions are cases in which two or more mesons are produced. Analysis of distributions of angles, momenta, and charges suggests a process for meson production in which the statistical model is slightly modified by a specific meson-nucleon interaction. The observed ratio of $\pi^- - n$ charge states $(n\pi^-\pi^0)$: $(p\pi^-\pi^-) = (1.8 \pm 0.6):1$ indicates that interactions proceeding through the isotopic spin $T = 3/2$ do not predominate. The prominence of $(p\pi^-\pi^-)$ and $(p\pi^-\pi^0)$ charge states together with a lack of correlation between emitted pion directions suggests that neither $T = 0$ nor $T = 1$ $\pi - \pi$ resonances play a significant role at this energy. (auth)

1615
ASSOCIATED PRODUCTION OF HYPERONS AND K MESONS. Saul Barshay (Univ. of California, Berkeley). Phys. Rev. 104, 853-5(1956) Nov. 1.

A suggestion for a possible interpretation of asymmetries in angular distributions of Λ° and K° particles from pion-nucleon and nucleon-nucleon collisions and of Σ^- and K^+ particles from pion-nucleon collisions is made. It involves a coupling between pions and K mesons and coupling between pions and hyperons. (T.R.H.)

Refer also to abstract 1676.

NEUTRONS

1616 HW-38235(Rev.)
Hanford Atomic Products Operation, Richland, Wash.
RESONANCE CAPTURE OF NEUTRONS IN METAL AND OXIDE CYLINDERS. M. V. Davis. June 29, 1956. Decl. Nov. 28, 1956. 11p. Contract W-31-109-Eng-52. $0.25 (OTS).

Reactivity measurements conducted in the Hanford Test Pile are interpreted to yield the resonance integrals for uranium, uranium oxide, thorium and thorium oxide. The experiments were made using cadmium filters and are discussed in terms of the multiplication factor of the Hanford Test Pile. (auth)

1617
ANGULAR MOMENTUM ASSOCIATED WITH SLOW-NEUTRON RESONANCES. V. L. Sailor (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 104, 736-9(1956) Nov. 1.

Available data on the statistical weight factor g for $l = 0$ neutron resonances are summarized and the reliability of each result is discussed. There are reliable measurements for seventeen resonances which lie between 0 and 50 kev. In many cases, the results were obtained in two or more independent experiments. In sixteen cases, the compound nucleus has the spin $J = I + 1/2$, while in only one case the spin is $J = I - 1/2$. No data are available for weak resonances. Despite the limited data, it is strongly indicated that the compound nucleus is formed preferentially in the $I + 1/2$ spin state. At present there is no basis for deciding whether this result arises from a difference in the level spacing D, or a difference in the average neutron width $\bar{\Gamma}_n{}^0$ for the two possible spin states. Regardless of the source of this effect it is apparent that the frequent assumption – that the strength function $\bar{\Gamma}_n{}^0/D$ is the same for the two spin states – may not be correct. (auth)

NUCLEAR PHYSICS

1618 ORNL-2081
Oak Ridge National Lab., Tenn.
APPLIED NUCLEAR PHYSICS DIVISION ANNUAL REPORT FOR PERIOD ENDING SEPTEMBER 10, 1956. Nov. 20, 1956. 234p. Contract W-7405-eng-26. $1.25 (OTS).

Critical experiments, shielding studies, and basic nuclear physics pertinent to reactor design and operation are reported. Categories of research are H_2O moderated reactors, critical experiments, fission physics, reactor theory, shielding research, radiation detector development, and thermonuclear reactions. (D.E.B.)

1619
SATURATION OF NUCLEAR FORCES IN THE NON-LINEAR PSEUDOSCALAR MESON THEORY WITH VECTOR COUPLING. Y. Ahmavaara and P. Jauho. Ann. Acad. Sci. Fennicae Ser. A. I., No. 184, 1955. 13p. (In English)

A non-linear pseudoscalar meson theory with vestor coupling is investigated. It is shown that owing to the non-validity of the superposition principle, the presence of a non-linear term in the equation for meson amplitude leads even in this case to a saturation property for nuclear forces. Extended source nucleos and the classical field theory are used throughout the paper. (auth)

1620
NOTES ON A VARIATIONAL METHOD IN THE DEUTERON PROBLEM. K. V. Laurikainen. Ann. Acad. Sci. Fennicae Ser. A. I., No. 208, 1955. 7p.

A variational procedure in an eigen-value problem, met with when examining the ground state of the deuteron in the

case of tensor forces, is developed. A comparison is given between numerical results obtained when using an improved trial function and those obtained by others. (auth)

1621

ON THE COUPLING CONSTANTS IN β-DECAY. O. Kofoed-Hansen and A. Winther. Kgl. Danske Videnskab. Selskab, Mat.-Fys. Medd. 30, No. 20, (1956). 12p.

Recent experimental data on superallowed β-transitions are used in a redetermination of the β-decay coupling constants. It is suggested that the β-decay interaction may contain an admixture of vector coupling besides the usually adopted scalar and tensor interactions. (auth)

1622

ENERGY LEVELS OF C^{11} AND ANGULAR DISTRIBUTIONS OF SOME NEUTRON GROUPS FROM THE B^{10}(d,n) REACTION. M. Cerineo (Institute "R. Boskovic," Zagreb, Yugoslavia). Nuclear Phys. 2, 113-23(1956) Oct.

The energy spectrum and the angular distributions of separated neutron groups from the B^{10}(d, n) reaction at 7.55-Mev deuteron mean energy have been determined. The resulting information on the excited states of C^{11} is presented. The angular distributions obtained are in agreement with the stripping theory. (auth)

1623

COLLECTIVE NUCLEAR MOTION AND THE EFFECTIVE MASS OF A NUCLEON. R. J. Blin-Stoyle (Clarendon Lab., Oxford, England). Nuclear Phys. 2, 169-72(1956) Oct.

It is suggested that the energies of rotational levels in nuclei indicate that the effective mass of a nucleon in a nucleus is approximately one-half the actual mass. (auth)

1624

THE INTERACTION LAGRANGIAN FOR FUNDAMENTAL PARTICLES. Abdus Salam (St. John's Coll., Cambridge, England). Nuclear Phys. 2, 173-6(1956) Oct.

On the basis of d'Espagnat and Prentki's classification, the interaction Lagrangian is written down for all strong reactions of fundamental particles. Use is made of the invariance requirement for particle-antiparticle conjugation. (auth)

1625

RADIALLY SYMMETRIC SOLUTIONS OF BETHE-SALPETER EQUATION. S. N. Biswas and H. S. Green (Univ. of Adelaide, Australia). Nuclear Phys. 2, 177-87(1956) Oct.

New exact solutions are obtained of the Bethe-Salpeter equation for a pair of fermions, in the ladder approximation and for zero boson mass. The solutions are applicable for small but non-vanishing total energy, and for scalar or pseudoscalar boson fields with ordinary or derivate coupling. A boundary condition, similar to that applied to the Schrödinger equation in three dimensions, is proposed, which reduces the continuum of eigenvalues for the coupling constant to a set of discrete values, except in the case of s(s) coupling. It is pointed out that this boundary condition also implies the existence of a new quantum number, with properties similar to those of the "strangeness" number already used to classify the new particles. (auth)

1626

ON THE CHARGE INDEPENDENCE OF NUCLEAR FORCES. Riazuddin (Fitzwilliam House, Cambridge, England). Nuclear Phys. 2, 188-91(1956) Oct.

The possibility that the discrepancy between the zero energy scattering lengths A_{NP}, A_{PP} for ^1S states of the NP and PP systems may be due to the mass difference between charged and neutral pions is investigated. (auth)

1627

ON THE COLLECTIVE DESCRIPTION OF NUCLEAR SURFACE OSCILLATION. T. Tamura (Univ. of Copenhagen, Denmark). Nuovo cimento (10) 4, 713-35(1956) Oct.

A general method for a collective description of a many-particle system, which was introduced by Miyazima and the present author and applied to the case of weak coupling surface oscillation of the atomic nuclei, is extended here to the case of strong coupling, and the results are compared with those of other authors. (auth)

1628

ON A NEW NUCLEON-NUCLEON POTENTIAL. E. Clementel and C. Villi (Istituto di Fisica dell'Universita, Padova and Istituto di Fisica dell'Universita, Trieste). Nuovo cimento (10) 4, 935-9(1956) Oct.

1629

ON THE CONSERVATION OF THE NUCLEONS. B. Ferretti (Istituto di Fisica e Scuola di Perfezionamento in Fisica Nucleare dell'Universita, Rome). Nuovo cimento (10) 4, 951-2(1956) Oct.

1630

SCATTERING OF K PARTICLES. M. Widgoff and A. M. Shapiro (Harvard Univ., Cambridge, Mass.); R. Schluter, D. M. Ritson, and A. Pevsner (Massachusetts Inst. of Tech., Cambridge); and V. P. Henri (Northeastern Univ., Boston). Phys. Rev. 104, 811-15(1956) Nov. 1.

An experiment has been performed to investigate the relative probability of scattering of $K_{\pi 2}$ and τ mesons. If, as is thought on the basis of the analysis of Dalitz and others, these particles differ in spin-parity properties, they may be expected to have different scattering cross sections, and the relative proportions of τ and $K_{\pi 2}$ mesons in a beam of scattered K particles would differ from their relative proportions in a beam of directly-produced particles. In the present experiment, a measurement was made of the composition of a K^+-particle beam in which it is estimated that more than ~75% of the particles had undergone scattering. Comparison with other results on the composition of beams consisting predominantly of directly-produced particles indicates that the relative numbers of τ and $K_{\pi 2}$ mesons are unchanged, within ~30%. The results are therefore consistent with the assumption that the τ and $K_{\pi 2}$ are the same particle. (auth)

1631

INTRINSIC MOMENTS OF ELEMENTARY PARTICLES. Jane Pease (Northeastern Univ., Boston) and Robert L. Pease (Tufts Univ., Medford, Mass.). Phys. Rev. 104, 816-21(1956) Nov. 1.

A system described by a first-order linear field equation, with matrix coefficients satisfying the general commutation rules of degree n derived by Bhabha, is assumed to interact with an external electromagnetic field. By manipulation of permutations of the operators involved, a systematic procedure is developed for extracting the intrinsic moments of a system of arbitrary n; such moments are found to exist up to and including 2^{n-1} -pole order. The (covariant) interactions are simplified by considering the system in one of its rest states. An explicit formula for the magnetic dipole moment is derived and compared with the result obtained for a special case by Harish-Chandra. (auth)

1632

POSSIBLE INTERFERENCE PHENOMENA BETWEEN PARITY DOUBLETS. T. D. Lee and C. N. Yang (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 104, 822-7 (1956) Nov. 1.

Possible interference phenomena between parity doublets are discussed. In particular, the decay particle distributions of $\Sigma^{\pm}$ and Λ^0 produced in $K^- + p$ capture and in $\pi^- + p$ collision are analyzed. These distributions may have interference terms with odd parity. Experimental detection of such terms would constitute an unambiguous proof of the existence of parity doublets. It is further pointed out that

such interference terms have a rather interesting time dependence. (auth)

1633

CONVERGENCE OF THE TAMM-DANCOFF FORMALISM. William C. Meecham (Univ. of Michigan, Ann Arbor). Phys. Rev. 104, 828-31(1956) Nov. 1.

A sufficient condition for the convergence of the Tamm-Dancoff formalism is shown. The special problem considered is that of describing a single spinless nonrelativistic nucleon in the presence of a neutral scalar meson field. The formalism is seen to converge for the cutoff momentum somewhat less than the rest mass of the meson. (auth)

1634

RELATIONSHIP BETWEEN THE SCATTERING OF HIGH-ENERGY DIRAC AND KLEIN-GORDON PARTICLES. George Parzen (Univ. of Notre Dame, Ind.). Phys. Rev. 104, 835-8(1956) Nov. 1.

Relationships have been found between the scattering of a high-energy relativistic particle that obeys the Dirac equation and one that obeys the Klein-Gordon equation. The phase shifts at high energies are related by $\delta_l = \frac{1}{2}(\eta_l + \eta_{l+1})$, where δ_l and η_l are the Dirac and Klein-Gordon phase shifts, respectively; and the cross sections are related by $\sigma_D(\theta) = \sigma_K(\theta)\cos^2(\frac{1}{2}\theta)$, where σ_D and σ_K are the Dirac and Klein-Gordon cross sections, respectively. The errors in these relations are discussed and the results of a numerical calculation using a square well potential are given to illustrate the accuracy of the above relations. (auth)

NUCLEAR PROPERTIES

1635 AECD-3729

Los Alamos Scientific Lab., N. Mex.

COINCIDENT MEASUREMENT OF THE VELOCITIES OF FISSION FRAGMENTS FROM U^{235}. William E. Stein. [1955]. Decl. Jan. 18, 1956. 21p. Contract W-7405-eng-36. $4.80(ph OTS); $2.70(mf OTS).

The velocities of the fragment pairs formed by slow-neutron-induced binary fission of U^{235} were determined and the masses and energies of the fragments before prompt neutron emission were determined on the basis of reasonable assumptions concerning the mechanism of prompt neutron emission. (F.S.)

1636 CRRP-667

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

CALCULATED CROSS SECTIONS OF IRRADIATED THORIUM (REVISED). D. G. Hurst. Oct. 1956. 17p. (AECL-364).

Calculated cross sections of initially pure Th and U^{233} are tabulated as functions of irradiation. (J.H.M.)

1637 LA-524(Del.)

Los Alamos Scientific Lab., N. Mex.

THE CALCULATION OF CRITICAL MASSES INCLUDING THE EFFECTS OF THE DISTRIBUTION OF NEUTRON ENERGIES. R. P. Feynman, T. A. Welton, J. Ashkin, R. Ehrlich, M. Peshkin, and F. Reines. Jan. 21, 1947. Decl. with deletions May 6, 1955. 138p. Contract [W-7405-eng-36]. $21.30(ph OTS); $6.90(mf OTS).

Convenient approximate methods are developed for the calculation of critical sizes and multiplication rates of spherical, active cores surrounded by infinite reflectors. Special attention is given to those problems arising from the fact that neutrons of different velocities have different properties. The methods consist essentially of approximating the neutron densities at each velocity by fundamental mode shapes for each velocity. Each one of these shapes forms a source of neutrons of all velocities, and simple considerations of the number and spatial distribution of absorptions from these sources determine the critical size at which equilibrium between production and absorption is achieved. The accuracy obtained is apparently sufficient for all practical purposes. Modifications of the method for systems of shapes other than spherical or having finite reflectors are discussed. (auth)

1638 OSR-TN-56-535

Yale Univ., New Haven.

FINE STRUCTURE OF THE GROUND STATES OF N^{15} AND O^{17}. Cabell A. Pearse. Oct. 31, 1956. 39p. Contract AF-18(600)-771. (AD-110354).

An attempt has been made to fit the experimental values of the ground state splittings for N^{15} and O^{17} using the same nucleon-nucleon spin-orbit force for both cases. It is found that the spin-orbit force constants for the N^{15} case must be made about twice as large as those for the O^{17} case. The magnitudes of the spin-orbit force parameters required to account satisfactorily for the N^{15} and O^{17} ground state splittings have been found to be from 5 to 10 times larger than those necessary to obtain agreement between the calculated and the experimental values of the ground state splitting in Li^7. The exchange integral contributions to the splittings have been found to be from $\frac{1}{4}$ to $\frac{1}{2}$ of the direct integral contributions; therefore, the concept of a one-body spin-orbit force is not accurately applicable in the cases of the N^{15} and O^{17} ground state splittings. Gauss error potentials and wave functions have been used. The wave function range parameters have been adjusted by means of experimental Coulomb energies and examined by means of binding energies. Effects of excited configurations have not been included and no claim of an exhaustive consideration of all possible adjustments of wave function and potential parameters is made. (auth)

1639

A STATISTICAL THEORY OF ARTIFICIAL NUCLEAR REACTIONS. Pekka Jauho. Ann. Acad. Sci. Fennicae Ser. A. I., No. 186, 1955. 10p.

A purely statistical theory of Bohr's compound nucleus model is presented. A formula $\delta = \frac{D^2}{E} \cong 1$ is derived for the ratio of the mean square deviation to the mean value for disintegrations through a chosen channel initiated with n bombarding particles of any kind but leading to the same compound nucleus. This formula can occasionally be checked experimentally and is then recognizable as the square root of $E(\overline{\lambda}_n)$ law, whose approximate validity is thus shown to follow from Bohr's assumptions. (auth)

1640

THE HALF-LIFE OF Ni^{63}. C. C. McMullen, B. D. Pate, R. H. Tomlinson, and L. Yaffe (McGill Univ., Montreal and McMaster University, Hamilton, Ont.). Can. J. Chem. 34, 1742-6(1956) Dec.

The half-life of Ni^{63} has been found by a specific activity determination to be 125 ± 6 years. The number of atoms of Ni^{63} was determined mass spectrometrically and the disintegration rate by $4\pi\beta$-counting. The cross section for the reaction $Ni^{62}(n,\gamma)Ni^{63}$ has been found to be 21 ± 2 barns, in good agreement with that found by Pomerance. (auth)

1641

MOLYBDENUM-99 IN URANIUM SALTS AND THE SPONTANEOUS FISSION HALF-LIFE OF URANIUM-238. P. L. Parker and P. K. Kuroda (Univ. of Arkansas, Fayetteville). J. Chem. Phys. 25, 1084-5(1956) Nov.

Experiments are described from which it was determined that the spontaneous fission half life of U^{238} is $(8.4 \pm 0.8) \times 10^{15}$ yr. The occurrence of Mo^{99} in U salt was determined and taken into account. (T.R.H.)

1642

DIFFERENTIAL ELASTIC SCATTERING OF 14 MEV NEUTRONS IN LEAD, MERCURY, AND ZINC. H. Nauta. Nuclear Phys. 2, 124-31(1956) Oct.

The differential cross sections for the elastic scattering of 14-Mev neutrons from lead, mercury and zinc have been measured in a ring geometry using a biased detector with a spherical liquid scintillator. The measurements were taken over the angular range between 15° and 125°. The results are in qualitative agreement with theoretical predictions. (auth)

1643

PROPERTIES OF LOW LYING LEVELS IN Mg^{25}. H. E. Gove, G. A. Bartholomew, E. B. Paul, and A. E. Litherland (Atomic Energy of Canada Ltd., Chalk River, Ont.). Nuclear Phys. 2, 132-46(1956) Oct.

The reaction Mg^{25} (pp'γ)Mg^{25} and the negaton decay of Na^{25} have been used to study the first four excited states of Mg^{25} at 0.58, 0.98, 1.61, and 1.96 Mev. The 0.98-Mev level decays to the level at 0.58 Mev or to ground by gamma emission in the intensity ratio 51:49. The 1.61-Mev level decays to ground > 96% of the time. The 1.96-Mev level decays to the level at 0.98 Mev or 0.58 Mev or to ground in the intensity proportions 25:50:25. A study of the gamma rays following negaton decay of Na^{25} shows that the levels in Mg^{25} at 0.98 and 1.61 Mev are fed by negaton transitions. Gamma rays due to negaton transitions to the 0.58 state are less than 3% of the total. Comparisons between the gamma-ray branching ratios of levels in Mg^{25} and those in Al^{25} indicate that the 0.58-, 0.98-, and 1.96-Mev levels in Mg^{25} have spins and parities $\frac{1}{2}$+, $\frac{3}{2}$+ and $\frac{5}{2}$+ respectively, while that at 1.61 Mev is probably $\frac{7}{2}$+. The most likely spin and parity assignments for the ground state of Na^{25} are $\frac{5}{2}$+. (auth)

1644

AN INVESTIGATION OF THE FIRST ROTATIONAL LEVEL OF ^{169}Tm. A. Bisi, S. Terrani, and L. Zappa (Istituto di Fisica Sperimentale del Politecnico, Milan). Nuovo cimento (10) 4, 758-63(1956) Oct.

The possibility of the β decay of Er^{169} to the known rotational levels of Tm^{169} has been investigated. No evidence of a complex decay was found. The transition energy results: E_0 = (340 ± 2) kev and the half-life: $T_{1/2}$ = (9.0 ± 0.2) days. The low energy transitions of Tm^{169} from the decay of Yb^{169} were investigated with a proportional counter spectrometer and by using a coincidence technique. The 23.4-kev γ ray arising in the transition between the third and the second rotational level was observed; its relative intensity was obtained. No clear evidence was found of a γ ray which should have arisen from the deexcitation of the first rotational level. (auth)

1645

SPIN OF NEON-21. J. C. Hubbs and G. M. Grosof (Columbia Univ., New York). Phys. Rev. 104, 715-17(1956) Nov. 1.

The spin of Ne^{21} has been shown to be $\frac{3}{2}$ by the atomic beam magnetic resonance method utilizing the metastable $2p^5 3s\ ^3P_2$ state of neon. The assignment is made from a comparison of Zeeman frequencies in Ne^{20} and Ne^{21} at the same magnetic field. (auth)

1646

NUCLEAR ENERGY LEVELS OF Os^{188}. V. R. Potnis (Bartol Research Foundation, Swarthmore, Penna.). Phys. Rev. 104, 722-7(1956) Nov. 1.

The beta and gamma radiation of the 18-hour Re^{188} have been examined with scintillation and magnetic spectrometers. Of the total beta disintegrations, 79% lead to the ground state, 20% to the first excited state at 155 kev, and 1% to the other excited states of Os^{188}. The beta-ray spectra leading to the ground state and the first two excited states of Os^{188} are first forbidden. Thirteen gamma rays have been detected. Extensive gamma-gamma coincidence studies were made. The K-shell conversion coefficient of the 155-kev gamma ray has been obtained which agrees quite well with the E2 assignment for that gamma ray. The K/L ratio also supports this assignment. No conversion electrons corresponding to the 478-kev gamma ray were found and it is concluded that it is primarily E2 in nature with a small admixture of M1 transition. A decay scheme is proposed on the basis of these data. (auth)

1647

ENERGY LEVELS OF Si^{28}. A. G. Rubin and F. Ajzenberg-Selove (Boston Univ., Mass.) and Hans Mark (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 104, 727-30 (1956) Nov. 1.

The neutron spectrum from the Al^{27}(d,n)Si^{28} reaction has been investigated at eight angles by means of nuclear emulsions. The energy of the incident deuterons was 2.167 ± 0.015 Mev. The data indicate energy levels of Si^{28} at 1.78 ± 0.10, 4.54 ± 0.2, 4.95 ± 0.2, 6.24 ± 0.06, 6.88 ± 0.06, 7.39 ± 0.06, 7.89 ± 0.06, 8.31 ± 0.10, 8.57 ± 0.08, 9.37 ± 0.04, 10.00 ± 0.10, and 10.25 ± 0.06 Mev. (auth)

1648

ROTATIONAL AND INTRINSIC LEVELS IN Tm^{169} AND Lu^{175}. E. N. Hatch, F. Boehm, P. Marmier, and J. W. M. DuMond (California Inst. of Tech., Pasadena). Phys. Rev. 104, 745-52(1956) Nov. 1.

Nuclear levels in Tm^{169} excited by electron capture of Yb^{169}, and levels in Lu^{175} excited by both beta decay of Yb^{175} and electron capture of Hf^{175} have been studied by using the curved-crystal gamma-ray spectrometer and the ring-focusing beta-ray spectrometer, as well as a semicircular beta-ray spectrometer for low energies. From the precision energies and the multipolarity determinations, the levels in Tm^{169} have the following energies in kev, and spin and parity assignments: A (ground state) ($\frac{1}{2}$+), B 8.42 ($\frac{3}{2}$+), C 118.20 ($\frac{5}{2}$+), D 138.95 ($\frac{7}{2}$+), E 316.19 ($\frac{7}{2}$+), F 379.31 ($\frac{7}{2}$−), G 472.91 ($\frac{9}{2}$−). Levels A, B, C, and D are members of a rotational band whose characteristic constants are given. Levels E and F are interpreted as particle excitations and level G as a rotational level based on the state F. The Lu^{175} excited states have the following energies in kev, spins, and parities: A (ground state) ($\frac{7}{2}$+), B 113.81 ($\frac{9}{2}$+), C 251.46 ($\frac{11}{2}$+), D 343.40 ($\frac{5}{2}$+), E 396.31 ($\frac{9}{2}$−), F 432.76 ($\frac{7}{2}$+), G 504.7 ($\frac{7}{2}$+). A, B, and C form a rotational band for which the characteristic constants are given. Some features of the levels and transition probabilities are discussed and compared with the unified model. A brief survey of second-order rotational energy constants and of intrinsic excitation levels is given. (auth)

1649

SPIN OF RUBIDIUM-81m. J. C. Hubbs, W. A. Nierenberg, H. A. Shugart, and H. B. Silsbee (Univ. of California, Berkeley). Phys. Rev. 104, 757-8(1956) Nov. 1.

The nuclear spin of 31.5-min Rb^{81m} has been measured by the atomic beam resonance method. The result is I = $\frac{9}{2}$. (auth)

1650

NUCLEAR MAGNETIC SPIN-LATTICE RELAXATION IN LIQUIDS. H. S. Gutowsky and D. E. Woessner (Univ. of Illinois, Urbana). Phys. Rev. 104, 843-4(1956) Nov. 1.

The proton and fluorine spin-lattice relaxation times for CH_2FCl, CHF_2Cl, $CHFCl_2$, and 1,3,5-trifluorobenzene are measured and discussed. (T.R.H.)

1651

VARIATIONAL CALCULATION OF MAGNETIC SHIELDING OF PROTONS IN THE HYDROGEN MOLECULE. T. P.

Das and R. Bersohn (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 104, 849(1956) Nov. 1.

A variational function has been found which is suitable for calculation of the diamagnetic shielding constant for protons in the H_2 molecule. (T.R.H.)

1652

NEUTRON AND PROTON DISTRIBUTIONS IN Pb. A. Abashian, R. Cool, and J. W. Cronin (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 104, 855-6(1956) Nov. 1.

The values for the ratio $Q = [\sigma(\pi^-) - \sigma(\pi^+)]/\sigma(\pi^+)$ in Pb are calculated and determined experimentally and compared. (T.R.H.)

1653

ISOTOPE SHIFTS AND HYPERFINE STRUCTURE IN THE ATOMIC SPECTRUM OF CADMIUM. H. G. Kuhn and S. A. Ramsden (Univ. of Oxford, England). Proc. Roy. Soc. (London) A237, 485-95(1956) Nov. 20.

The isotope shifts in the spark line λ 4416 of cadmium ($4d^{10}\ 5p^2P_{\frac{1}{2}} - 4d^9\ 5s^{22}\ D_{\frac{1}{2}}$) are accurately measured by means of single and double Fabry–Perot etalons and with the use of electromagnetically enriched isotopes. The shifts between successive even isotopes are found to decrease with increasing neutron number in an irregular manner. Accurate values are obtained for the odd-even and odd-odd shifts in λ 4416; this involved the study of the h.f.s. of the lines λ 3250 and λ 3535. Pronounced odd-even staggering is found. Some conclusions on the change of nuclear deformation with neutron number are drawn and possible connexions with shell structure discussed. (auth)

1654

PROGRESS IN NUCLEAR ENERGY. SERIES I. PHYSICS AND MATHEMATICS. R. A. Charpie, J. Horowitz, D. J. Hughes, and D. J. Littler, eds. New York, McGraw-Hill Book Co., Inc., 1956. 398p. $12.00(OTS).

This volume presents a summary of results, and methods for their analysis, pertaining to the properties of the fissionable nuclei. The latter part of the volume includes materials on "Reactor Physics," and involves the techniques used in planning experiments with reactors. The results and methods presented will be of great value to workers in reactor design. (auth)

NUCLEAR REACTORS

1655 AECU-3319

Internuclear Co., Inc., Clayton, Mo.

SELECTION OF A FOOD IRRADIATION REACTOR TYPE. PHASE 1. July 1, 1956. 78p. (INTERNUC-2). $0.45 (OTS).

Initial appraisals of reactor types for use in food irradiation facilities are reported. The use of direct core, primary coolant, fission product gas, and secondary neutron capture mediums as the gamma source were considered for both heterogeneous and homogeneous reactors. The most promising prospect appears to be a heterogeneous reactor using an MTR-type fuel element, H_2O cooling, and an $In_2(SO_4)_3$ aqueous solution as the gamma emitter. (D.E.B.)

1656 CF-51-5-98(Vol. II, Pt. I)

Oak Ridge National Lab., Tenn.

THEORY OF NEUTRON CHAIN REACTIONS. VOLUME II, PART I. HOMOGENEOUS NUCLEAR CHAIN REACTIONS. CHAPTER V. NEUTRON CHAIN REACTIONS. CHAPTER VI. PILE EQUATIONS. CHAPTER VII. THEORY OF REFLECTORS AND THE METHOD OF GROUPS. Alvin M. Weinberg and L. C. Noderer. Aug. 10, 1951. Decl. Aug. 26, 1955. 173p. Contract [W-7405-eng-26]. $27.30(ph OTS); $8.10(mf OTS).

The results obtained in the previous section of this book on neutron diffusion are applied to the theory of slow neutron chain-reacting systems. The chapters are on neutron chain reactions, reactor equations, the theory of reflectors and the method of groups. (F.S.)

1657 HW-40930

Hanford Atomic Products Operation, Richland, Wash.

EXPONENTIAL PILE MEASUREMENTS IN WATER MODERATED LATTICES WITH ENRICHED URANIUM RODS. E. D. Clayton. Appendix II: BUCKLING CALCULATIONS FOR ONE PER CENT ENRICHED URANIUM–WATER ROD LATTICES. H. Neumann. Jan. 16, 1956. Decl. Nov. 28, 1956. 45p. Contract W-31-109-Eng-52. $0.40(OTS).

The results of a series of buckling measurements involving the use of enriched U rods (1.007% by weight U^{235}) in light water are presented. The buckling was determined for two rod sizes. The water-to-U-volume ratios were found. The information obtained with the preceding rod sizes and H_2O/U-volume ratios was sufficient (when coupled with existing data for other rod sizes) to estimate the maximum obtainable buckling for 1.007% U in light water. A curve is given relating maximum buckling with H_2O/U-volume ratio and rod diameter from which estimates may be made regarding criticality hazards with the 1.007% enriched U. The effect of replacing a water reflector with one of uranyl nitrate solution of two different concentrations. Some information was also obtained on the extrapolation length to be used in unreflected cases. (auth)

1658 IDO-16004

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

PRE-OPERATIONAL ACCEPTANCE TEST PROCEDURES FOR THE MATERIALS TESTING REACTOR. PART I. PRE-NEUTRON TESTS. Feb. 29, 1952. Decl. Sept. 12, 1955. 267p. Contract AT(10-1)-205. $45.00(ph OTS); $11.10(mf OTS).

This manual was prepared for the purpose of defining acceptance checks and tests to be made on reactor components and plant equipment for the Materials Testing Reactor. These preneutron acceptance tests were designed to be performed prior to reactor operation. The material includes the reactor and its facilities, the reactor plant supporting systems, and reactor control instrumentation. A description of the equipment to be tested is followed by the proposed test procedure. Descriptions of specific tests for some systems are appended. (C.H.)

1659 KAPL-M-DRB-1

Knolls Atomic Power Lab., Schenectady, N. Y.

EFFECTS OF ROD SHAPE ON CONTROL ROD WORTH. D. R. Bach and S. W. Kitchen. Oct. 30, 1956. 21p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Measurements were made of the effectiveness of axial slab and cross control rods in a highly enriched, polyethylene moderated cylindrical critical assembly. Materials studied include Cd, Hf, and B dispersions in Al. These experiments were initiated in order to determine the applicability of the absorption area concept to practical reactor problems. The data indicate that for the range of thicknesses and materials studied, geometry and transmission effects on control rod worth are separable. In addition, the ratio of the worth of a slab of width 2a to that of a cross of width 2a having the same transmission is independent of the transmission. If the absorption area concept is to have meaning, two absorbers occupying the same position in a reactor and having the same absorption area must necessarily have the same control effectiveness

if the migration area is greater than the absorption area. This type of comparison of theory with data shows good agreement. A direct comparison of the calculated absorption area with measured rod effectiveness shows that for the range of $\Delta k/k$ measured, a thermal diffusion length of 0.6 inches, and for $1'' \leq a \geq 4''$, $\Delta k/k$ is proportional to the absorption area. (auth)

1660

NUCLEAR ENERGY AND THE EXPORT MARKET. M. D. Wood. Nuclear Eng. 1, 325-8(1956) Nov.

The optimum type of reactor for a particular generating system will depend largely on the power requirement. Before undertaking a development program to produce export units. It is necessary that a close examination of the future market be made. Due allowance must be made for changes in demand during the development period. (auth)

1661

PROBLEMS OF LIQUID-METAL-FUELLED REACTORS. B. R. T. Frost (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Eng. 1, 334-9(1956) Nov.

The state of technical development of the fused salt reactors and the liquid-metal-fuelled reactors is reviewed and major unsolved problems are discussed. (F.S.)

1662

SWISS HEAVY-WATER RESEARCH REACTOR. Nuclear Eng. 1, 340-1(1956) Nov.

Data sheet and specifications are given for the Swiss heavy-water research reactor which will be used to provide data for future power-station designs. (F.S.)

1663

A 5-W LABORATORY REACTOR. NEW AMERICAN DESIGN FOR TECHNICAL COLLEGES AND MEDICAL SCHOOLS. Nuclear Eng. 1, 344-5(1956) Nov.

A miniature research reactor small enough for educational, industrial, or medical laboratories is described. It is capable of a wide range of studies in the engineering, biological and medical fields and requires little space and no special facilities or services. (F.S.)

1664

THE WORLD'S REACTORS. NO 7. 5-MW POWER REACTOR. Nuclear Eng. 1, 330a(1956) Nov.

The data sheet, including specifications and drawings of the 5-Mw power reactor used for electric power stations in Russia, is given. (F.S.)

1665

RESEARCH REACTORS—U. S. MANUFACTURERS REACTORS FOR EXPORT. Nucleonics 14, No. 11, 70-5(1956) Nov.

A list of the reactors offered by U. S. manufacturers for export is presented. The reactor type, power level, average thermal flux, moderator, reflector, fuel enrichment, critical mass, total fuel required for initial loading, frequency of refueling, safety features, price range, arrangements for shipment and installation abroad, and responsibilities the company takes are given. (W.L.H.)

1666

RESEARCH REACTORS—SELECTION AND OPERATION. William M. Breazeale (Babcock & Wilcox Co., Lynchburg, Va.). Nucleonics 14, No. 11, 76-80(1956) Nov.

The selection and characteristics of the water-boiler, open-pool, and tank-type research reactors as to neutron flux, fuel requirements, experimental programs, operating personnel, operating costs, and safety considerations are discussed. (W.L.H.)

1667

SUBCRITICAL REACTOR IS USEFUL FOR RESEARCH AND TRAINING. Alan B. Smith (Argonne National Lab., Lemont, Ill.). Nucleonics 14, No. 11, 81-3(1956) Nov.

The ANL subcritical reactor is described. Results are presented of buckling experiments. (W.L.H.)

1668

FUEL COSTS IN HOMOGENEOUS U^{235} BURNERS. P. R. Kasten and H. C. Claiborne (Oak Ridge National Lab., Tenn.). Nucleonics 14, No. 11, 88-91(1956) Nov.

Nuclear power in the 10 to 100 Mw range at 10 to 14 mills/kwh could be produced in scattered locations completely divorced from chemical processing plants (assuming 6 mills/kwh for power costs other than fuel costs. "Throwaway" fuel cost is 4 mills/kwh for the optimum reactor for U fuel cost of $15 or about 8 mills/kwh for 30/gm U^{235}. Operation in excess of 25 yr with no fuel processing appears possible from a nuclear standpoint. Recovery of spent fuel did not significantly lower the fuel costs. Heavy-water-moderated reactors showed a slight cost advantage over those moderated by H_2O. (auth)

1669

MOCKUP TESTS DETERMINE HOW TEST-CELL VOIDS AFFECT REACTIVITY. J. R. Bohannon, Jr. (Wright Air Development Center, Dayton, Ohio). Nucleonics 14, No. 11, 92-5(1956) Nov.

The proposed design of the NETR is presented. The major objects of the experimental program were to determine the change in reactivity that would result from flooding one of the proposed test-all voids without a thermal-neutron curtain between the core face and void, the effectiveness of a "black" thermal-neutron curtain (Cd or B) in reducing the reactivity change for such accidential flooding. The probable upper limit of positive reactivity introduced by fast-neutron backscattering from test material, and associated data for detailed analysis of reactor response to the preceding reactivity changes. (W.L.H.)

1670

WESTINGHOUSE TESTING REACTOR. M. A. Schultz (Westinghouse Electric Corp., Pittsburgh). Nucleonics 14, No. 11, 138-44(1956) Nov.

A description is given of the Westinghouse Testing Reactor which is to be placed in operation in late 1957. The reactor, using highly enriched U as fuel and H_2O as coolant and moderator, operates at 20 Mw with provision for going to 60 Mw. It is to be a versatile facility for irradiation under conditions of high pressure, high temperature, and high flux. (T.R.H.)

Refer also to abstract 1501.

NUCLEAR TRANSFORMATION

1671

PROMPT GAMMA RAYS ACCOMPANYING THE SPONTANEOUS FISSION OF Cf^{252}. A. B. Smith, P. R. Fields, and A. M. Friedman (Argonne National Lab., Lemont, Ill.). Phys. Rev. 104, 699-702(1956) Nov. 1.

Single- and multiple-crystal scintillation techniques are utilized to measure the energy spectrum of prompt gamma rays emitted in the spontaneous fission of Cf^{252}. It is found that each fission yields an average of 10.3 photons having a total energy of 8.2 Mev. These photons are heterogeneous in energy. An upper limit is placed on the intensity of neutrons and quanta emitted in the order of 10^{-9} second after fission. (auth)

1672

NUCLEAR EXCITATION FUNCTIONS AND THICK TARGET YIELDS: (Cr + d). Peter Kafalas and John W. Irvine, Jr. (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 104, 703-5(1956) Nov. 1.

Nuclear excitation functions and thick-target yields have been determined for several reactions which occur when Cr of natural isotopic composition is bombarded with deuterons of ~15 Mev. The reactions are $Cr^{52}(d,2n)Mn^{52}$, $[Cr^{53}(d,n)M^{54}$, $Cr^{54}(d,2n)Mn^{54}]$, $[Cr^{50}(d,p)Cr^{51}$, $Cr^{50}(d,n)Mn^{51} \xrightarrow{\beta} Cr^{51}$, $Cr^{52}(d,t)Cr^{51}]$, and $Cr^{50}(d,\alpha)V^{48}$. The excitation function for $Cr^{53}(d,n)$ was approximated by correcting for $Cr^{54}(d,2n)$ but the complex reactions yielding Cr^{51} could not be completely analyzed. Stacked Cr foils were bombarded, Mn, Cr, and V isolated chemically and the activities of relatively long-lived products measured with a calibrated scintillation counter. Absolute cross sections were calculated for several of the reactions and thick target yields as a function of deuteron energy were calculated for the production of Mn^{52}, Mn^{54}, Cr^{51}, and V^{48}. The energy loss of deuterons in Cr has been measured over the range of 3.8 to 13.6 Mev and some beam straggling data are presented. (auth)

1673

GAMMA RAYS FROM THE PROTON BOMBARDMENT OF PHOSPHORUS. Bernard D. Kern and Lewis W. Cochran (Univ. of Kentucky, Lexington). Phys. Rev. 104, 711-14 (1956) Nov. 1.

The yield of gamma rays from the proton bombardment of phosphorus has been obtained for proton energies from 0.4 to 2.0 Mev. There are seen in this region nineteen resonances, corresponding to energy levels in S^{32} at energies from 9.295 to 10.775 Mev. The energy spectra of the gamma rays emitted at several of the resonances have been obtained and interpreted in terms of levels in the residual nucleus S^{32}. The spectra indicate that a 3.8-Mev gamma ray is present; from a tentative assignment of it to the second excited state to ground state transition there follows the result that the second excited state of S^{32} has J = 1, even parity. (auth)

PARTICLE ACCELERATORS

1674 MURA-203

Midwestern Universities Research Assn., Urbana, Ill.

MISALIGNMENTS IN THE MICHIGAN RADIAL SECTOR FFAG ACCELERATOR. F. T. Cole, L. W. Jones, C. H. Pruett, and K. M. Terwilliger. Nov. 5, 1956. 13p. Contract AT(11-1)-384. $3.30(ph OTS); $2.40(mf OTS).

Experiments and calculations are described which test the effects of misalignments in the Michigan radial sector FFAG betatron. In the experiments, one magnet is moved and the equilibrium orbit deviation measured. The calculations are done in the hard-edge approximation, where the effects of magnet edges are approximated by impulsive lenses. Agreement between theory and experiment is considered good. (auth)

1675 NYO-7816

Rochester, New York. Univ.

MODIFICATIONS OF THE OSCILLATOR OF THE ROCHESTER 27 INCH VARIABLE ENERGY CYCLOTRON. Miodrag Petrovich, Charles A. Preskitt, Jr., and Arthur K. Hamann. Oct. 26, 1956. 15p. Contract AT(30-1)-875. $3.30(ph OTS); $2.40(mf OTS).

A study is reported which was carried out to determine changes necessary in the oscillator system of the 27-in. cyclotron for acceptable operation and to overcome the unsatisfactory starting characteristics and to produce sufficiently high dee voltage to accelerate the highest-energy protons to the deflector radius. (F.S.)

Refer also to abstract 1556.

RADIATION ABSORPTION AND SCATTERING

1676

MAGNETIC ANALYSIS OF REACTIONS $pp \rightarrow np\pi^+$(I), $pp \rightarrow pp\pi^0$(II), and $pp \rightarrow d\pi^+$(III) AT 660 MEV. M. G. Meshcheryakov, B. S. Neganov, I. K. Vzorov, V. P. Zrelov, and A. F. Shabudin (Inst. of Nuclear Problems). Doklady Akad. Nauk S.S.S.R. 109, 499-502(1956) July 21. (In Russian)

The impulse spectra and angular distributions of secondary protons emitted in reactions (I) and (II) at an energy level of 660 Mev were studied to determine the process of π-meson production in (p-p) collisions. Experiments were made to separate the secondary particles formed in reaction (III) from the general flux, to determine the power of their polarization, and to accomplish complete phenomenological analysis of reaction (III), including the relation between the intensity of possible transitions of meson emission in the p-state: $^1S_0 \rightarrow {}^3S_1$, and $^1D_2 \rightarrow {}^3S_1$. The experiments were made with the 6-meter synchrocyclotron using proton beam with flux density of 3×10^9 proton/cm^2. The energy of the protons was (660 ± 3) Mev and the half-width spectra was ±5 Mev. The design of the spectrometer and its position in relation to the primary beam and the concrete shield for measuring the spectra under 7° angle are presented. (R.V.J.)

1677

INELASTICITY IN COLLISIONS BETWEEN PIONS AND LEAD NUCLEI. M. Cresti, W. D. B. Greening, L. Guerriero, A. Loria, and G. Zago (Istituto di Fisica dell'Universita, Padova) and M. Deutschmann (Mas-Planck-Institut für Physik, Göttingen, Germany). Nuovo cimento (10) 4, 746-57(1956) Oct.

From direct measurements of the energy of charged pions (from 0.5 to 5 Bev) interacting with Pb nuclei, and of the energy of the neutral pions produced in these interactions, the fraction of the primary energy radiated as π^0 mesons is shown to be 0.17 ± 0.04; from this follows a mean inelasticity $\bar{\gamma} \approx 0.5$. The data show that low and high values of γ are preferred, with a minimum at intermediate values. (auth)

1678

EVALUATION OF THE SCATTERING LENGTHS IN PION-NUCLEON SCATTERING. J. Orear (Columbia Univ., New York). Nuovo cimento (10) 4, 856-9(1956) Oct.

All the pion-proton scattering data below 60 Mev which provide values and errors for the phase shifts have been used to obtain the s-wave scattering lengths. The results are $a_1 = 0.167 \pm .012$ and $a_3 = -0.105 \pm .010$. The value $(a_1 - a_3) = 0.26 \pm .04$ as obtained from recent photoproduction results, and Panofsky ratio values were also used. The scattering length for α_{33} becomes $a_{33} = 0.22 \pm .03$ if one assumes the linear Chew-Low energy dependence up to 170 Mev. (auth)

1679

GRAPHICAL DETERMINATION OF THE PATH OF A SCATTERED PARTICLE. N. C. Barford and G. T. Reynolds (Imperial Coll., London). Nuovo cimento (10) 4, 929-32 (1956) Oct.

1680

THE ELASTIC SCATTERING OF PROTONS BY LIGHT ELEMENTS. G. Dearnaley (Cavendish Lab., Cambridge, England). Phil. Mag. (8) 1, 821-34(1956) Sept.

The elastic scattering of protons by F^{19}, Be^9 and Na^{23} has been studied over a range of angles and energies between 0.5 and 2.6 Mev. The anomalies observed in the scattering cross section curve at resonances excited in the compound nucleus have been analysed using dispersion theory. Resonance energies, widths and partial widths are deduced, and

conclusions are given as to spins and parities of various states in Ne^{20}, B^{10} and Mg^{28} based on this and other evidence. (auth)

1681

COULOMB SCATTERING OF RELATIVISTIC ELECTRONS BY POINT NUCLEI. Noah Sherman (Univ. of California Radiation Lab., Livermore). Phys. Rev. 103, 1601-7(1956) Sept. 15.

The Mott series for the Coulomb scattering of electrons by point nuclei have been evaluated numerically with the aid of the UNIVAC computer. Calculations of the series for $F(\theta)$ and $G(\theta)$, the scattering cross section, and the polarization asymmetry factor, $S(\theta) = \delta^{\frac{1}{2}}$, were performed for scattering by nuclei of charge Z equal to 80, 48, and 13 at ratios of electron velocity to light velocity, $\beta = v/c$, equal to 0.2, 0.4, 0.5, 0.6, 0.7, 0.8, and 0.9. The results are tabulated. (auth)

1682

SCATTERING OF $D(d,n)He^3$ POLARIZED NEUTRONS BY C^{12}. B. M. McCormac, M. F. Steuer, C. S. Bond, and F. L. Hereford (Univ. of Virginia, Charlottesville). Phys. Rev. 104, 718-21(1956) Nov. 1.

The right-left asymmetry of $D(d,n)He^3$ neutrons scattered by C^{12} was observed for various neutron emission angles, deuteron bombarding energies, and $C^{12}(n,n)$ scattering angles. Using a figure for carbon polarization based on a $C^{12}(n,n)$ phase shift analysis, the maximum neutron polarization was found to be (10.6 ± 1.0) % for neutrons produced at 53° (c.m.) by 600–700 kev deuterons on a thick target. Observation of the right-left asymmetry for different neutron scattering angles yielded a sin 2θ angular dependence of the carbon polarization in agreement with the prediction of the $C^{12}(n,n)$ phase shift analysis. (auth)

1683

INTERACTION OF 0.5- AND 1.0-MEV NEUTRONS WITH SOME HEAVY ELEMENTS. R. C. Allen, R. B. Walton, R. B. Perkins, R. A. Olson, and R. F. Taschek (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 104, 731-5 (1956) Nov. 1.

The angular distributions of 0.5-Mev neutrons elastically scattered by Au, Bi, U^{238}, U^{235}, and Pu^{239} and of 1.0-Mev neutrons elastically scattered by the latter three materials have been measured. The differential and total elastic scattering cross sections, the elastic transport cross sections, and the inelastic collision cross sections are presented. Some theoretical angular distributions and cross sections based on a complex square-well model for U^{238} are also included. The angular distributions of fission neutrons produced by 0.5- and 1.0-Mev incident neutrons are found to be isotropic, and the ratio of $\bar{\nu}(Pu^{239})$ to $\bar{\nu}(U^{235})$ is 1.3 ± 0.2 at both energies. (auth)

1684

HIGH-ENERGY PROTON-PROTON SCATTERING AND THE LÉVY POTENTIAL. M. S. Wertheim, M. H. Hull, Jr., and A. M. Saperstein (Yale Univ., New Haven, Conn.). Phys. Rev. 104, 764-7(1956) Nov. 1.

The predictions of Lévy's potential for high-energy proton-proton scattering have been examined. The potential was used in the form of Blatt and Kalos, and contains three adjustable parameters. Values of the parameters that fit the low-energy data as well as values that lead to approximately correct total cross sections at high energies have been tried. Phase shifts obtained by numerical integration at several energies were used to calculate the cross section and the polarization. Definite disagreement with experimental results was found. Features of Lévy's potential responsible for the disagreement are discussed. (auth)

1685

POLARIZATION OF PROTONS ELASTICALLY AND INELASTICALLY SCATTERED IN G5 EMULSION. Jerome I. Friedman (Enrico Fermi Inst. for Nuclear Studies, Chicago). Phys. Rev. 104, 794-9(1956) Nov. 1.

Measurements have been made of the polarization resulting from both the elastic and inelastic scattering of high-energy protons in Ilford G5 emulsion. The elastic polarization was measured by measuring the azimuthal asymmetry of the elastic scattering in emulsion of 0.64 ± 0.04 polarized, 310 ± 5 Mev protons from the University of Chicago synchrocyclotron. The average polarization resulting from elastic scattering between 3 and 15° in the laboratory system is 0.44 ± 0.13. Emulsion was exposed to a 0.76 ± 0.03 polarized, 316 ± 4 Mev proton beam from the Berkeley synchrocyclotron for the measurement of polarization due to inelastic scattering. The light prongs of the stars produced in the emulsion show a definite asymmetry. This asymmetry is increased by requiring of the light prongs an angle-energy correlation consistent with quasi-elastic scattering. The data indicate that the polarization decreases with larger prong number stars. From the 304 meters of track scanned in the measurement of elastic polarization, data have been collected on the cross sections of 305 ± 5 Mev protons in G5 emulsion. (auth)

1686

DISPERSION CONTRIBUTION TO HIGH-ENERGY ELECTRON-DEUTERON SCATTERING. H. S. Valk and B. J. Malenka (Washington Univ., St. Louis, Mo.). Phys. Rev. 104, 800-4(1956) Nov. 1.

An attempt is made to estimate the contribution of the intermediate nuclear virtual states to the high-energy electron elastic scattering cross section in the special case of the deuteron. A method is developed by which the nuclear excited states can be approximated by suitably modified free-nucleon wave functions in the sum over intermediate states. Expressions for the contribution to the cross section arising from the cross terms between the first- (in e^2) and second-order terms of the scattering amplitude are obtained and some numerical results are presented. Some disagreement with previous assumptions as to the magnitude of the "true" dispersion correction is indicated. (auth)

1687

ADIABATIC APPROXIMATION FOR SCATTERING PROCESSES. David M. Chase (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 104, 838-42(1956) Nov. 1.

The adiabatic approximation, frequently utilized in treating bound states of quantum-mechanical systems, is shown to be applicable also to scattering processes in cases for which the number of excited states of the target contributing significantly to the wave function is limited, and for which the time of traversal of the scattered particle through the region of interaction is small compared with the period of the target motion excitable in the collision. In this approximation, calculation of partial inelastic cross sections is reduced to two steps: (1) determination of the elastic scattering amplitude for fixed target coordinates and (2) subsequent evaluation of scalar products in the space of the target. The method is illustrated by means of a simple one-dimensional example. Calculation of cross sections for nuclear rotational excitation by neutrons is formulated. (auth)

1688

UNIQUENESS OF SOLUTIONS OF THE BETHE-SALPETER EQUATION FOR SCATTERING. S. Mandelstam (Univ. of Birmingham, England). Proc. Roy. Soc. (London) A237, 496-512(1956) Nov. 20.

The Bethe–Salpeter equation for nucleon-nucleon scattering is a singular integral equation, and it is therefore not certain that a unique solution exists. It is shown that the equation is soluble for states of all angular momentum, parity and isotopic spin if, and only if, $g^2/4\pi$ is less than $\frac{1}{4}\pi$. The range of values of g for which there exist solutions of a particular angular momentum and parity is given. The Bethe–Salpeter equation for meson-nucleon scattering is also examined. In this case, the equation is soluble for all values of the coupling constant, but the solution, regarded as a function of g, will exhibit discontinuities when g passes through certain values. (auth)

1689

COMPTON BACKSCATTERED PHOTONS IN PRECISION PROPORTIONAL COUNTER SPECTROMETRY. R. W. Fink and B. L. Robinson (Univ. of Arkansas, Fayetteville). Rev. Sci. Instr. 27, 712-13(1956) Sept.

The importance of Compton backscattering in gas proportional spectrometry in the energy range 10 to 100 kev is pointed out. If the backscattered photons are unresolved from the main peak, a large error may be introduced under certain conditions in absolute and relative intensity measurements based on theoretical quantum efficiency (geometry × absorption); if the backscattered peak is resolved, failure to recognize its origin may result in the "discovery" of a new gamma ray. The effect is especially pronounced when a collimator is used to establish geometry; for example, the intensity of backscattered photons can amount to as much as half the intensity of the main peak at 46.5 kev with a ¼-in. diameter collimator. (auth)

1690

CORRECTION FOR PHOSPHOR BACKSCATTERING IN ELECTRON SCINTILLATION SPECTROMETRY. M. S. Freedman, T. B. Novey, F. T. Porter, and F. Wagner, Jr. (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 27, 716-19(1956) Sept.

An iterative numerical integration procedure has been developed to correct both beta spectra and differential beta-gamma directional correlations for the effects of finite instrument energy resolution including the effect of backscattering from a scintillation detector. The method has been tested and found to reproduce the true spectral shape in the cases of Re^{186}, Au^{198}, Tl^{204}, and to allow separation of composite beta spectra as in the case of W^{187}. Application of the method is limited to maximum beta energies exceeding 200 kev. (auth)

RADIATION EFFECTS

1691

PARAMAGNETIC RESONANCE OF LATTICE DEFECTS IN IRRADIATED QUARTZ. R. A. Weeks (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 27, 1376-81(1956) Nov.

Various kinds of silica glass and natural and synthetic crystals have been irradiated with fast neutrons at temperatures of ~250°C and above 300°C. In the glasses, asymmetric paramagnetic resonance lines resulting from the irradiation have been observed with apparent g values of 2.0013 ± 0.0006 and 2.0090 ± 0.0007, and half-widths of ≈1.7 gauss and ≈40 gauss, respectively. Two groups of lines were found in the natural crystals and have been associated with the two lines in the glasses, the two lines in the glasses being the envelope of the lines in the crystals when they are summed over random orientations with respect to the magnetic field. On the basis of g values, absence of common impurity and of hyperfine splitting, and the thermal stability of the lines, it is concluded that the observed resonances in the silica glasses and crystals have their origin in defects in the basic SiO_4 tetrahedra generated by fast neutrons and primary and secondary knockons. From preliminary optical bleaching data in neutron irradiated Corning silica it is tentatively concluded that the resonance with g = 2.0013 is associated with the defect which gives rise to an optical absorption band at 2120 A. The g values of the two lines in the silica glasses suggest that one center is an electron and the other a hole. (auth)

1692

ELECTRON IRRADIATION OF COPPER BELOW 10°K. J. W. Corbett, J. M. Denney, M. D. Fiske, and R. M. Walker (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 104, 851-2(1956) Nov. 1.

The change in electrical resistivity in a thin, very pure, Cu foil bombarded by 1.35-Mev electrons below 10°K is reported. (T.R.H.)

RADIOACTIVITY

1693

ON THE RATIO BETWEEN γ-AND α-ACTIVITIES IN ^{210}Po. A. Ascoli, M. Asdente, and E. Germagnoli (Laboratori CISE, Milan). Nuovo cimento (10) 4, 946-7(1956) Oct.

The γ/α ratio was determined for Po^{210} using a thin source electroplated onto Pt and covered with a thin mica sheet. The γ activity was measured using a single crystal scintillation spectrometer, and the α activity was measured with a thin CsI crystal. A value of γ/α of $(1.21 \pm 0.08) \times 10^{-5}$ was found, giving a value of $(1.25 \pm 0.08) \times 10^{-5}$ for the branching ratio. (B.J.H.)

1694

MESONIC DECAY IN FLIGHT OF A TRITON HYPERFRAGMENT. F. Brisbout, M. W. Friedlander and P. Iredale (Univ. of Bristol, England). Nuovo cimento (10) 4, 948-50 (1956) Oct.

A detailed description is given of a star in a nuclear emulsion which is due to the decay of a triton hyperfragment. (B.J.H.)

1695

DECAY SCHEME OF Mo^{91}. F. B. Smith, Jr., N. B. Gove, R. W. Henry, and R. A. Becker (Univ. of Illinois, Urbana). Phys. Rev. 104, 706-10(1956) Nov. 1.

Gamma-radiation energies were measured at 1540 ± 20, 1210 ± 30, and 658 ± 3 kev, all of which decay with the known 65.5-second half-life. Three positron groups were found to be involved in the same decay. The end-point energies of these were found to be 3.99 ± 0.05, 2.78 ± 0.10, and 2.48 ± 0.10 Mev. No gamma radiation was found decaying with the longer 15-minute half-life. A single positron group with this longer half-life was found to have an end point of 3.44 ± 0.03 Mev. The long-lived positrons represent a transition between the ground states of Mo^{91} and Nb^{91}, whereas the 65-second positrons proceed from a 658-kev excited state of Mo^{91} to three excited states in Nb^{91}, the lowest of which is the well-known 104-kev excited state. The two higher excited states decay by gamma emission to this state. (auth)

1696

DECAY OF Cl^{39}. J. R. Penning, H. R. Maltrud, J. C. Hopkins, and F. H. Schmidt (Univ. of Washington, Seattle). Phys. Rev. 104, 740-4(1956) Nov. 1.

The beta- and gamma-ray spectra of 55-minute Cl^{39} were studied by means of magnetic and scintillation spectrometers. A first forbidden unique (ΔI = 2, yes) beta transition takes place to the ground state of A^{39} in 7 ± 2% of all decays with an end-point energy of 3.45 ± 0.02 Mev and a log ft value of 7.8 (log f_1t = 8.3). Beta transitions to the second excited level of A^{39} at 1.52 Mev take place in 85 ± 6% of the transitions and have an end-point energy of 1.91 ± 0.02 Mev (log ft = 5.57). The remaining 8 ± 4% of

the beta transitions take place to the first excited level at 1.266 Mev (log ft = 6.8). Three gamma rays were found with energies of 0.246 ± 0.003, 1.266 ± 0.010, and 1.520 ± 0.010 Mev, and relative intensities of 0.9 ± 0.1, 1, and 0.85 ± 0.05, respectively. The 0.240- and 1.266-Mev gamma rays are in cascade. Each of the three gamma rays is in coincidence with beta rays with end-point energies of 1.90 ± 0.05 Mev. A beta-gamma delay is observed with a half-life of $(0.95 \pm 0.05) \times 10^{-9}$ second. The metastable level is shown to be the second excited state. A decay scheme based on these data is proposed. (auth)

1697

INTERNAL CONVERSION IN Hg^{198}. John Volpe and George Hinman (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 104, 753-6(1956) Nov. 1.

The K-shell conversion coefficients of the 676 and 1088-kev γ rays of Hg^{198} have been measured to be $\alpha_K(676) = 0.019 \pm 0.005$ and $\alpha_K(1088) = 0.0046 \pm 0.0006$. The 676-kev γ ray is shown to be a mixture of M1 and E2 radiations in approximately equal amounts. (auth)

1698

ISOBARIC LEVEL STRUCTURE FOR A = 47. L. J. Lidofsky and V. K. Fischer (Columbia Univ., New York). Phys. Rev. 104, 759-63(1956) Nov. 1.

The radioactive properties of Ca^{47}, Sc^{47}, and V^{47} have been studied. Ca^{47} was found to have a half life of 4.7 ± 0.1 days and to emit β radiation in groups of 1940 ± 20 kev (17%) and 660 ± 10 kev (83%) maximum energy. Also observed in the decay were γ rays of energy 1.31 ± 0.02, 0.83 ± 0.02, and 0.48 ± 0.02 Mev and intensities in the ratio of 13 ± 2:1 ± 0.1:1, respectively. Sc^{47} emits a 160 ± 5 kev γ ray and β radiation in groups of 610 ± 5 kev (26%) and 450 ± 10 kev (74%) maximum energy. The γ ray spectrum of V^{47} was studied and an upper limit of 0.8% was set on the ratio of 160-kev gamma rays to positrons. (auth)

1699

INTERPRETATION OF THE EXPERIMENTAL RESULTS OF ANGULAR CORRELATION. P. C. Macq and M. De Hemptinne (Universite de Louvain). Nuclear Phys. 2, 160-8(1956) Oct. (In French)

Fuchs' theory of angular correlation for the β–γ cascade of type $2^- \rightarrow 2^+ \rightarrow 0^+$ is generalized and applied to the discussion of the experimental results for Rb^{86} and Cl^{38}. (auth)

1700

ECONOMICAL AND VERSATILE Co^{60} GAMMA-RAY SOURCE. E. R. Johnson, R. Bruce, R. Steinmann, and V. Cagnat (Stevens Inst. of Tech., Hoboken, N. J.). Nucleonics 14, No. 11, 119-20(1956) Nov.

SHIELDING

1701

GAMMA-RAY STREAMING THROUGH AN ANNULUS. David G. Chappel (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 14, No. 11, 87(1956) Nov.

A nomogram is presented that permits rapid and accurate determination of the geometrical attenuation of the γ flux from an emitting surface onto which the annulus abuts perpendicularly. (W.L.H.)

1702

MODULAR CAVE FOR STORING RADIOACTIVE METAL PARTICLES. L. E. Preuss (Edsel B. Ford Inst. for Medical Research, Detroit). Nucleonics 14, No. 11, 111-12 (1956) Nov.

An inexpensive storage shield for handling radioactive particles, foils, and wires is described. (T.R.H.)

1703

SOLID METAL HYDRIDES AS REACTOR MODERATORS. H. M. McCullough and B. Kopelman (Sylvania Electric Products, Bayside, N. Y.). Nucleonics 14, No. 11, 146-53 (1956) Nov.

The potentialities of solid metal hydrides as reactor moderators are discussed. The properties of LiH, NaH, KH, CaH_2, SrH_2, BaH_2, and ZrH_2 are tabulated. It is concluded that the hydrides of Ce, Zr, and Ca are possible moderator materials while hydrides of Hf, Ta, and Nd show promise as shielding materials. Transition metal hydrides deserve closer investigation. (T.R.H.)

1704

HOW FLOW PATTERNS AFFECT SHIELD DESIGN. George T. Dib (Blaw-Knox Co., Pittsburgh). Nucleonics 14, No. 11, 154-6(1956) Nov.

A mathematical analysis of the effect of flow patterns on shielding designs for tanks, vessels, etc., is given. (T.R.H.)

SPECTROSCOPY

1705

REDUCED COMPTON EFFECT SCINTILLATION SPECTROMETER. K. I. Roulston and S. I. H. Navqvi (Univ. of Manitoba, Winnipeg, Canada). Rev. Sci. Instr. 27, 830-2 (1956) Oct.

To assess the effectiveness of plastic phosphors in the reduction of Compton effect in scintillation spectrometers, a spectrometer with a small NaI(Tl) crystal surrounded by a large plastic phosphor has been constructed. The output from the plastic phosphor is put in anticoincidence with the output from the NaI(Tl) crystal. A reduction of Compton contribution in the scintillation spectrum to about 35% of original value is obtained. Comparison of results with, and without, the shield enables certain spectral features to be identified. Possible applications are discussed. Transistor anticoincidence circuits are used. (auth)

THEORETICAL PHYSICS

1706

DISPERSION RELATION OF FERMI PARTICLES. V. Fainberg and E. Fradkin (Lebedev Inst. of Physics). Doklady Akad. Nauk S.S.S.R. 109, 507-10(1956) July 21. (In Russian)

The quantum field theory is based on general requirements of relativistic invariability, causality, and boundary conditions (with $t \rightarrow \pm \infty$ particles are free and have the required mass). However, the attempts to solve the equations of the theory by concrete expression of the interaction showed the intrinsic mathematical incompleteness (renormalized charge was equal to zero). A derivation based on the requirements of the theory which does not depend on the concrete expression of the interaction but is capable of yielding to experimental verification should coordinate the theory and the fact. One of such derivations was found in the dispersion equation connecting the factual and imaginary parts of the forward dispersing amplitude. Derivation for the dispersion relation of Fermi particles was sought in the presented calculations. (R.V.J.)

1707

CORRELATION SPLITTING IN HELIUM-LIKE IONS. Harrison Shull (Iowa State Coll., Ames) and Per-Olov Löwdin (Uppsala Univ., Sweden). J. Chem. Phys. 25, 1035-40(1956) Nov.

The correlation effects in the ground state of the He-like ions are investigated by using the idea that the two electrons may occupy different orbitals in space. By using a scale factor η and a splitting parameter ν, a radial function $\varphi[r]$ is split into two different orbitals, $\varphi[\eta(1+\nu)r]$ and $\varphi[\eta(1-\nu)r]$. It is shown that by using orbitals obtained by splitting

a simple exponential function, a surprisingly large amount of the radial correlation energy may be taken into account, whereas an attempt to split the atomic self-consistent field function for He led to a negative result. The lowest triplet state is also treated by using the same approach. (auth)

1708

EFFECT OF DISTRIBUTION OF NUCLEAR CHARGE ON ANGULAR CORRELATION IN BETA-DECAY. A. Z. Dolginov and I. N. Toptigin (Physico-Technical Inst. of the Acad. of Sci., Leningrad). Nuclear Phys. 2, 147-59(1956) Oct.

The $\beta-\nu$ and $\beta-\gamma$ angular correlation has been computed with consideration of finite electron wavelength for the cases of uniform volume and surface nuclear charge distributions. The calculations were carried out for linear combinations of various forms of beta decay interactions. It is shown that for transitions of first degree of forbiddenness the calculations yield results which perceptibly differ from those of existing approximate calculations. In some cases the difference was as high as 50%. The problem of choosing a nucleus which is most suitable for $\beta-\gamma$ angular correlation studies is discussed. A comparison of the theory with experiment is made for the Tm^{170} nucleus. (auth)

URANIUM AND URANIUM COMPOUNDS

1709 AECU-3381

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

MEASUREMENT OF THERMAL CONDUCTIVITY OF URANIUM OXIDE. Final Report. J. C. Hedge and I. B. Fieldhouse. Sept. 20, 1956. 12p. Project No. G022-D3. For Westinghouse Electric Corp. Atomic Power Div. $3.30(ph OTS); $2.40(mf OTS).

Thermal conductivity of UO_2 having a density of 8.17g/cc has been measured in the temperature range of 400 to 3030°F using the Powell stacked disk method. The thermal conductivity of Armco iron was measured on the apparatus used for this investigation and results which check within 2% of the accepted values were obtained. Since difficulties were encountered in the preparation of test specimens which were free of cracks, it was agreed to first attempt to obtain data up to 3000°F and then, if possible, to continue the measurement up to 4400°F. Upon examining the UO_2 disks after the measurement at 3030°F, it was evident that the disks were so badly cracked that further measurements were impossible. (auth)

1710 BMI-1135

Battelle Memorial Inst., Columbus, Ohio.

THE ELECTRICAL PROPERTIES OF URANIUM OXIDES. Robert K. Willardson, Jerry W. Moody, and Harvey L. Goering. Sept. 25, 1956. Decl. Nov. 2, 1956. 42p. Contract W-7405-eng-92. $0.40(OTS).

The electrical conductivity and thermoelectric power of U oxides in the $UO_2-U_3O_7$ range were studied at temperatures between 27 and 400°C after annealing at 200, 400, 600, 800, and 1000°C. The following compounds were identified: UO_{2+x}, as a metal-deficit semi-conductor; U_4O_{9-y}, as a metal-excess semiconductor; and U_3O_{7-z}, as a metal-excess semiconductor. The presence of all major phases was confirmed by x-ray powder techniques. The basic crystal lattice is the same for the three compounds. However, O_2 in excess of an O_2/U ratio of 2.00 goes into interstitial positions and uniformly contracts the lattice of UO_2 with increasing interstitial O_2, contracts lattice a fixed amount for U_4O_9, or contracts the lattice preferentially to give the slightly tetragonal U_3O_7 structure. An energy of about 0.4 ev is required to free a positive carrier from the interstitial oxygen in UO_{2+x}. In U_4O_9 or U_3O_7, the energy required to free an electron from the hexavalent U varied from 0.4 ev at high carrier concentrations to 0.9 ev at the lower concentrations. A correlation between the p-type electrical productivity, and the reduction in volume of pressed UO_2 at elevated temperatures was observed. The percentage shrinkage of p-type UO_2 is a linear function of conductivity (and O_2 content) when sintering is done under conditions which minimize loss of O_2. The electrical conductivity of sintered UO_2 which did not sinter to high densities exhibited an anomalous decrease as a function of increasing temperature at about 400°C. This decrease was not observed in the active oxides, which sintered to high densities. (auth)

1711

PHASE CHANGES IN PILE-IRRADIATED URANIUM-BASE ALLOYS. M. L. Bleiberg, L. J. Jones, and B. Lustman (Westinghouse Electric Corp., Pittsburgh). J. Appl. Phys. 27, 1270-83(1956) Nov.

Specimens of U-9, -10.5, -12, and -13.5 w/o (weight percent) Mo and U-10 w/o Nb, heat treated to retain the metastable gamma phase at room temperature and also to transform this phase to the room temperature stable phases, were irradiated in the Materials Testing Reactor (MTR) at maximum temperatures of less than 200°C. Electrical resistivity, temperature coefficient of electrical resistivity, hardness, and density measurements as well as x-ray diffraction patterns indicated that the stable phases at room temperature reverted to the metastable gamma phase during irradiation. No apparent changes in the microstructures of thermally transformed specimens were observed after irradiation. Lack of observable microstructural changes was attributed to the development of a ghost structure. X-ray line broadening measurements indicated essentially complete homogenization of thermally transformed U–Mo alloy specimens during irradiation. The mechanism of the phase reversal was explained on the basis of the displacement spike hypothesis. (auth)

PATENTS

BIOLOGY

1712

MEANS FOR PROTECTING HUMAN BEINGS AND ANIMALS AGAINST THE BIOLOGICAL INJURIES CAUSED BY RADIATION. S. Missoten (Belgium). British Patent 755,242. Nuclear Eng. 1, 358(1956) Nov.

By combining materials to reduce the velocity of neutrons with material for absorbing the slowed-down neutrons and mixing these with heavy dense material and depositing on existing walls, protection from neutrons, gamma and x-rays is provided. (F.S.)

ENGINEERING

1713

ROCK-DRILLING APPARATUS. A. T. Holman and P. Stein (to Holman Brothers Ltd.). British Patent 755,439. Nuclear Eng. 1, 358(1956) Nov.

A rock-drilling unit is described in which the dry rock dust is withdrawn by suction, conveyed by a hose to a dust collector and monitored for radioactivity by a radiation detector mounted adjacent to the dust collector. (F.S.)

PHYSICS

1714

PROCESS OF AND APPARATUS FOR CARRYING OUT NUCLEAR REACTIONS (to Stichting voor Fundamenteel Onderzoek der Materie (Netherlands)). British Patent 755,495. Nuclear Eng. 1, 358(1956) Nov.

A reactor in which the nuclear fuel is circulated in heavy or ordinary water or molten metal under the influence of gravity in the liquid state is described. (F.S.)

1715

PROCESS FOR CARRYING OUT NUCLEAR FISSION REACTIONS (to Stichting voor Fundamenteel Onderzoek der Materie (Netherlands)). British Patent 755,598. Nuclear Eng. 1, 358(1956) Nov.

By careful selection of the design and dimensions of a reactor and the initial proportions of the quantities of moderator and fissile material, the reactor may be kept critical by gradually increasing the proportion between the quantities of moderator (heavy water) and fissile material (UO_3). (F.S.)

1716

METHOD AND APPARATUS FOR TESTING THE PRESENCE OF SPECIFIC ATOMIC ELEMENTS IN A SUBSTANCE. J. L. Putnam (to U. K. Atomic Energy Authority). British Patent 755,967. Nuclear Eng. 1, 358(1956) Nov.

The substance is irradiated with neutrons. The occurrence and energy of gamma rays emitted by the nuclei of the substance under test and by the nuclei of any intervening substance absorbing neutrons are detected by a scintillation counter and analysed in groups to determine the particular n, γ reaction and thus the particular elementary substance corresponding to each group. The apparatus may advantageously be employed for the assay of inaccessible substances, for example, in strata of boreholes through a 2-in. thick steel liner. (auth)